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ABSTRACT

This document combines three separately bound volumes, a student manual, an instructor's guide, and student learning activities designed for students who are either in beginning-level pharmacy technician courses or considering careers in pharmacy. The material is intended to relate training experience to information studied in the classroom. The self-paced material is competency based. The instructor's guide provides a list of suggested educational outcomes correlated to the units of instruction. A basic test is provided for each unit, along with answers to learning activities and tests. The guide also includes a competency chart and introduction to the SCANS (Secretary's Commission on Achieving Necessary Skills) competencies and skills. The student manual contains learning objectives, terms and definitions, and information relating to current techniques and practices. Topics addressed in the 24 units of the guide include the following: careers; ethics and customer relations; drug legislation; safety, dispensing; materials management; metrology; managing a pharmacy; drug names, sources, and dosages; routes of administration; cardiovascular drugs; gastrointestinal drugs; respiratory drugs; nervous system drugs; hormones; infectious diseases/cancer; nonprescription medications; nonprescription gastrointestinal products; analgesics; allergy, cough, and cold; nutritional supplements, vitamins, and minerals; skin products; weight control products; and health care accessories. The student learning activities guide provides individualized activities for each of the 24 units. Questions in activities are designed for practice in both basic performance and thinking skills, and activities for more advanced students are included. All activities are related to the SCANS competencies and skills. (KC)

ED 379 530

Working in Pharmacies

Instructor's Guide
Student's Manual
Student Learning Activities

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WORKING IN PHARMACIES

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INSTRUCTOR'S GUIDE

Working in Pharmacies

Instructor's Guide

By

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and

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Revised by

Helena J. Fair

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Foreword

Working in Pharmacies is designed for use by students investigating activities within the pharmacy or considering further training for a career in pharmacy. The material is designed to relate training experience to information studied in the classroom. Students using this material can work at their own pace, enabling them to concentrate on areas that best fit their specific needs. The material is competency-based, with educational outcomes stated for each unit. Information is relevant and current. *Working in Pharmacies* is made up of three separate publications.

- The Student's Manual contains learning objectives, terms and definitions, and information relating to current techniques and practices. Topics addressed are ethics and customer relations, drug legislation, safety, and material management. Careers and responsibilities in pharmacy are described. Dispensing and metrology are discussed. Later units are arranged into two major groups. The first group of units deals with prescription drugs as they pertain to various body systems. The second group presents information on nonprescription products for specific conditions.

- The Student Learning Activities are individualized and designed to encourage the student to carefully read and study information presented. Questions in activities are designed for practice in both basic performance and thinking skills. Each unit has a section for those students desiring more advanced study. The number completed may be negotiated. All activities are related to the SCANS competencies and skills. Instructors are encouraged to provide one set of activities for each student to facilitate learning.

- The Instructor's Guide provides a list of suggested educational outcomes correlated to the units of instruction. A basic test is provided for each unit. Instructors are encouraged to enlarge and/or individualize these. Answers to learning activities and tests are included. A competency chart is included. An introduction to the SCANS competencies and skills is presented.

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Suggested Educational Outcomes Addressed by Units in *Working in Pharmacies*

Below is a list of suggested educational outcomes for a secondary student assisting in pharmacy. These outcomes include minimum concepts and skills associated with an assistant in pharmacy.

1. Develop an awareness of ethical and legal aspects of pharmacy	Units 1–4
2. Communicate effectively with other health care professionals and patients/customers	Units 2, 5, 8
3. Assist with the preparation, recording, and pricing of prescriptions and drug orders	Units 5, 9
4. Stock, store, and order supplies and products used in pharmacy	Unit 6
5. Keep pharmacy and shelves clean and in order	Units 4, 24
6. Use computers for data entry and retrieval of records	Unit 8
7. Learn drug names, medical terminology, and abbreviations used in medicine and pharmacy	Units 5, 7, 9, 10
8. Learn the common uses and side effects of prescription and nonprescription drugs	Units 10–23

Answers
to
Learning Activities

UNIT 1 / Careers in Pharmacy

Learning Activity 1: Word Recognition

1. pharmakon
2. pharmacy
3. chymists, druggists
4. Philadelphia College of Pharmacy
5. b
6. j
7. d
8. f
9. g
10. i
11. c
12. a
13. e
14. k

Learning Activity 2: Education and Employment

1. Answers will vary with the facility.
2. 5 years
3. board of pharmacy
4. fee, completed application
5. a 1,000-hour internship
6. No. You would not have a license to submit for reciprocity in another state.
7. The University of Houston, The University of Texas at Austin, and Texas Southern University
8. community pharmacy, hospital pharmacy
9. drug wholesaling, research and manufacturing, pharmaceutical marketing and advertising, professional writing, teaching, and government service (any four)
10. the opportunities to serve the public, to have a responsible position in the community, to play a part in improving public health, to work with and earn the respect of professionals and others in pharmacy work, and to make a living in a challenging, ever-changing field
11. The hospital has a more formalized and coordinated structure. This structure lends itself to specialization.
12. expert on drugs, through in-service education of hospital staff
13. The Omnibus Budget Reconciliation Act of 1990 requires pharmacists to provide counseling for patients and to perform drug use reviews to detect and prevent problems with drug therapy.
14. Answers will vary.
15. List should be completed to the satisfaction of the instructor.

Learning Activity 3: Projects for More Advanced Study

1. Students will show the instructor the letters they have written to ask for catalogs before mailing. Charts or reports should be turned in for evaluation.
2. The student's report will include reasons the pharmacists gave for their career choices.
3. The course of study should include those courses in mathematics, biology, chemistry, physics, and English offered by the local high school. College courses should include English, biology, chemistry, physics, organic chemistry, mathematics, economics, and history.
4. Job descriptions and earnings will vary. Instructors should check for accuracy and completeness.
5. Reports will vary and must be evaluated by the instructor. Length should be determined by agreement between student and instructor.

UNIT 2 / Ethics and Customer-Patient Relations

Learning Activity 1: Questions on Ethical Relationships

1. concern for the health and well-being of the patient
2. *Laws* are correct behavior required by a government. *Ethics* are a set of moral principles or values.
3. a relationship of trust
4. the basic concept, do good and avoid evil
5. Answers will vary.
6. Use the personal touch, maintain a professional appearance, and be prompt and courteous.
7. Wear a smock or lab coat over clean, neat conventional clothes. Avoid unconventional footwear. Wear a name badge.
8. commercial
9. Be responsible to each individual patient. Share knowledge with the patient or customer. Communicate with people in terms they can understand. Certain aspects of a patient's medication are best left to the physician to discuss with the patient.
10. personal
11. information about proper administration, side effects, proper storage, or the need to use all the prescription up
12. when the medication is a placebo, when the physician is using an investigational drug, or when the patient is very young or elderly
13. drug abuse prevention, diabetes screening, high blood pressure screening, and disease prevention
14. participation in local government, service organizations, churches, youth groups, and civic activities
15. Customers are ill or have a member of the family who is ill. Also, it is a highly regulated, legally sensitive profession.
16. Listen carefully, and hear the person out. Let the person vent his or her irritation. Express your regret at any inconvenience the customer has experienced.

Learning Activity 2: Projects for More Advanced Thinking

1. Answers will vary.
2. Answers will vary but should include the following points:
   Listen to all Mr. Black has to say and record the information.
   Explain that the pharmacist is away and must check later when he returns; give Mr. Black an estimation of when he can expect a reply.
   Express regret at any inconvenience he has experienced.
3. Answers may vary. Possible choices are to do nothing and let the supervisor handle the situation; to talk again to Robert and threaten to report him; or to talk with the pharmacist about the poor customer service.
4. The summary should be evaluated by the instructor for completeness.

UNIT 3 / Drug Legislation

Learning Activity 1: Regulations and Regulatory Agencies

1. any drug or substance subject to any of the controls of the Federal Comprehensive Drug Abuse Prevention and Control Act of 1970
2. any drug that requires a prescription before it can be dispensed

3. Dispensing is more complicated because it may involve preparing, packaging, compounding, and labeling a drug or device for delivery. Distributing is delivery only.
4. Yes. The stricter law will prevail.
5. Food and Drug Administration, Drug Enforcement Administration
6. no
7. no
8. State Board of Pharmacy, Department of Public Safety (in Texas)
9. no
10. I, II, III, IV, V. Examples of the schedules will vary for II through V. None will be listed for I.
11. a file for Schedule II, a file for Schedules III, IV, and V, and a file for all other prescriptions
12. yes
13. a. Drug Enforcement Administration
    b. Food and Drug Administration
    c. over-the-counter
    d. Department of Public Safety

Learning Activity 2: Writing Letters for Information
Answers will vary depending on response to letters.

UNIT 4 / Safety

Learning Activity 1: Safety Regulations and Practices

1. a. freedom from harm or danger
   b. precautions taken against hazards in our surroundings
2. to assure safe and healthful working conditions for every worker in this country
3. Occupational Safety and Health Administration
4. Labor
5. faulty wiring and equipment, wet floors, poor lighting, cluttered walkways, cluttered work areas, coming in contact with patients with communicable diseases
6. (1) Stand close to object with feet apart.
   (2) Bend the knees, and keep the back straight.
   (3) Get a good grip, and keep object close to body.
   (4) Get help if object is too heavy.
7. Contamination and cross-contamination of drugs can be a very serious health problem. Physical appearance can attract or turn away customers and patients.
8. In hospital pharmacies, a laminar flow hood is used to help preserve sterility in the preparation of intravenous solutions.
9. so they will not be a hazard to anyone when the trash is picked up
10. clearly marked fire exits, fire extinguishers, aisles free of obstacles, flammables safely stored, combustibles kept away from fire sources
11. Cooperate with the robber. Make mental descriptive notes. Don't panic. Do not move anything. (any three)

Learning Activity 2: Situations

1. Do not touch or move anything. Contact the pharmacist by telephone for instructions. He will have to count all controlled substances. Contact the police and wait for them to arrive.
2. Leave it until the police come. When you are allowed, clean up the spill. If the area is large, you may need to rope it off until it dries.

3. (A) Bend the knees, and keep the back as straight as possible when lifting. Wear closed-toe shoes. (B) Carry objects close to the body.

Learning Activity 3: Projects for More Advanced Study

1. Drawing must be completed to the satisfaction of the instructor.
2. Hospital pharmacies will have a fire plan. Community pharmacies may or may not. Student should suggest a plan if none is available.
3. Guidelines must include cooperation with the robber, how to observe and describe the person, remaining calm, and leaving everything alone until the pharmacist can count the drugs.
4. Answers will vary.
5. Answers will vary, but the list should be complete.

UNIT 5 / Dispensing in the Pharmacy

Learning Activity 1: Prescriptions

1. strength and frequency of medication
2. an order from a physician for medicine(s)
3. (1) name and address of the patient
    (2) date of prescription
    (3) superscription—Rx symbol
    (4) inscription—list of ingredients and quantities
    (5) subscription—directions for compounding
    (6) transcription—directions for patient
    (7) physician's signature
4. a. superscription. *Rx* is the symbol for the Latin word *recipe.*
    b. transcription. *Sig* indicates the directions to the patient.
5. inscription
6. metric
7. The pharmacist compares the label with the original prescription to make sure that the drug and the dosage are correct.
8. the right patient, the right drug, the right dose, the right route, the right intervals
9. no
10. the patient's name, the prescription number, the physician's name, the patient's phone number
11. The patient should call the pharmacy to which he or she wants the prescription transferred. The information needed is the patient's name, the prescription number, the other pharmacy's phone number or fax number, and the patient's phone number. The pharmacist will call the original pharmacy for the prescription information and the last refill date. The pharmacist must call the physician for authorization to refill the prescription.

Learning Activity 2: Recognition of Abbreviations

1. m
2. h
3. f
4. e
5. i
6. j
7. n
8. b
9. c
10. o
11. k
12. d
13. p
14. q
15. a
16. v
17. w
18. x
19. s
20. r

Learning Activity 3: The Parts of a Prescription

1. patient's name and address
2. superscription
3. inscription
4. subscription
5. transcription
6. physician's signature
7. date of prescription

Learning Activity 4: Reading Prescriptions

1.	Patient:	Brenda Tice	Pen VK 500 mg #48 tab po qid for 12 days
	Doctor:	Hurwitz	Take 1 tablet orally 4 times daily for 12 days.
2.	Patient:	Carol Deiterich	Ampicillin 500 mg #14 i bid infection
	Doctor:	Greytok	Take 1 capsule twice daily for infection.
3.	Patient:	Jane Wilson	Vibramycin 100 mg #6 ii stat, i qd
	Doctor:	Egerton	Take 2 capsules now, then 1 daily.
4.	Patient:	Chip Byas	Donnatal 4 oz. i dr q 4 hr prn pain or burning
	Doctor:	Rothenberg	Take 1 teaspoon every 4 hours as needed for pain or burning.
5.	Patient:	Jackie Barnes	Monistat-7 i applicatorful pv q hs 7 d
	Doctor:	Falk	Insert 1 applicatorful vaginally at bedtime daily for 7 days.
6.	Patient:	Patricia Rawlins	Librax #100 ut dict.
	Doctor:	Vandiver	Take as directed.
7.	Patient:	Rosemary Hopkins	Lasix 40 mg #30 i. po. q.o.d. fluid retention
	Doctor:	Conway	Take 1 tablet every other day for fluid retention.
8.	Patient:	John Warford	Neosporin ophthalmic ointment 1/8 oz. apply o.u. qid
	Doctor:	Hesse	Apply to both eyes 4 times daily.
9.	Patient:	Kathy Holm	Robitussin DAC 4 oz. i dr q 3 to 4 h prn cough
	Doctor:	Smith	Take 1 teaspoon every 3 to 4 hours as needed for cough.
10.	Patient:	Shana Hoffman	Phenergan pedi 100 ml 5 ml po qid cough
	Doctor:	Hotz	Give 1 teaspoonful orally 4 times daily for cough.
11.	Patient:	Chad Marshall	Tigan 100 mg #12 Insert i pr q 4 h N & V
	Doctor:	Hargrove	Insert 1 suppository rectally every 4 hours for nausea and vomiting.
12.	Patient:	Bill Pierce	Aldomet 250 mg #100 i qid BP
	Doctor:	Carpenter	Take 1 tablet 4 times daily for blood pressure.

13.	Patient: Doctor:	Lee Rodriguez Basso	Garamycin ophthalmic drops 10 cc i gtt os qid Instill 1 drop into left eye 4 times daily.
14.	Patient: Doctor:	Carol Heimer Chapman	Isordil 2.5 mg SL #100 i tab SL qid s.o.b. Dissolve 1 tablet under tongue 4 times daily for shortness of breath.

Learning Activity 5: Projects for More Advanced Study

1. List should be checked for accuracy.
2. Collections and evaluations will vary.

UNIT 6 / Materials Management

Learning Activity 1: Receiving, Storing, and Distributing Drugs

1. (1) Has the shipment arrived at the right place?
   (2) Is the shipping container intact?
   (3) Does the packing slip agree with the contents of the shipment?
   (4) Does the packing slip agree with the original purchase order?
   (5) Are all of the items in the shipment in good condition?
   (6) Have you missed anything?
2. according to drug name, usually by generic name; according to dosage form; and according to manufacturer
3. a. cold—not over 8°C (46°F)
   b. cool—8° to 15°C (46° to 59°F)
   c. room temperature—15° to 30°C (59° to 86°F)
   d. warm—30° to 40°C (86° to 104°F)
   5. excessive heat—above 40°C (104°F)
4. childproof unless specially requested by customer, preferably in writing
5. name of pharmacy, name of product, strength, dosage form, amount present, pharmacy control number, expiration date (if any)
6. In the floor stock system, drugs are kept at the nursing station and replaced as they are dispensed to the patients.
7. medication errors, wastage, improper labeling, less control, inefficiency
8. In the unit-dose system, patient doses are dispensed from the pharmacy in single-dose packages.
9. A centralized pharmacy provides all of its services from one central place. A satellite or decentralized pharmacy provides services from different areas in the hospital, usually to serve a specific number of patients in the same general area.
10. when providing drugs to health facilities such as nursing homes

Learning Activity 2: Terminology

1. the handling of drugs and related products from the time they enter the pharmacy until they are dispensed
2. something that holds a drug or medication directly
3. indicates when a drug should *not* be used
4. placing a prescription into the proper container or repackaging from a bulk supply
5. During deliquescence, a substance melts or dissolves due to absorption of moisture. During efflorescence, a substance changes to powder due to loss of water, or crystallization.

6. loss of moisture to the atmosphere
7. a. protects from the effects of light
   b. protects from extraneous solids and from loss of the contents
   c. protects from contamination by liquids, solids, and vapors and from loss due to efflorescence, deliquescence, or evaporation
   d. impervious to air or any other gas
8. Both are single-unit containers. The single-dose container has contents for parenteral administration. The unit-dose container holds a quantity for administration other than parenteral.
9. A multiple-unit container permits withdrawal of portions of the contents without changing the strength, quality, or purity of the remaining contents.
10. A multiple-dose container is a multiple-unit container for parenterally administered medications only.

Learning Activity 3: Practices in Your Pharmacy (Projects for More Advanced Study)

1. Answers will vary by facility.
2. Procedure should be outlined, label contents listed, and safety measures described.
3. Answers will vary. If a flowchart is prepared, it should be accompanied by a discussion of problems with the system.
4. This question should be completed to the satisfaction of the instructor.
5. Times and suggestions should vary as determined by the student.
6. An example is peroxide in light-resistant containers. Examples will vary.

UNIT 7 / Metrology

Learning Activity 1: Measurement and Calculation

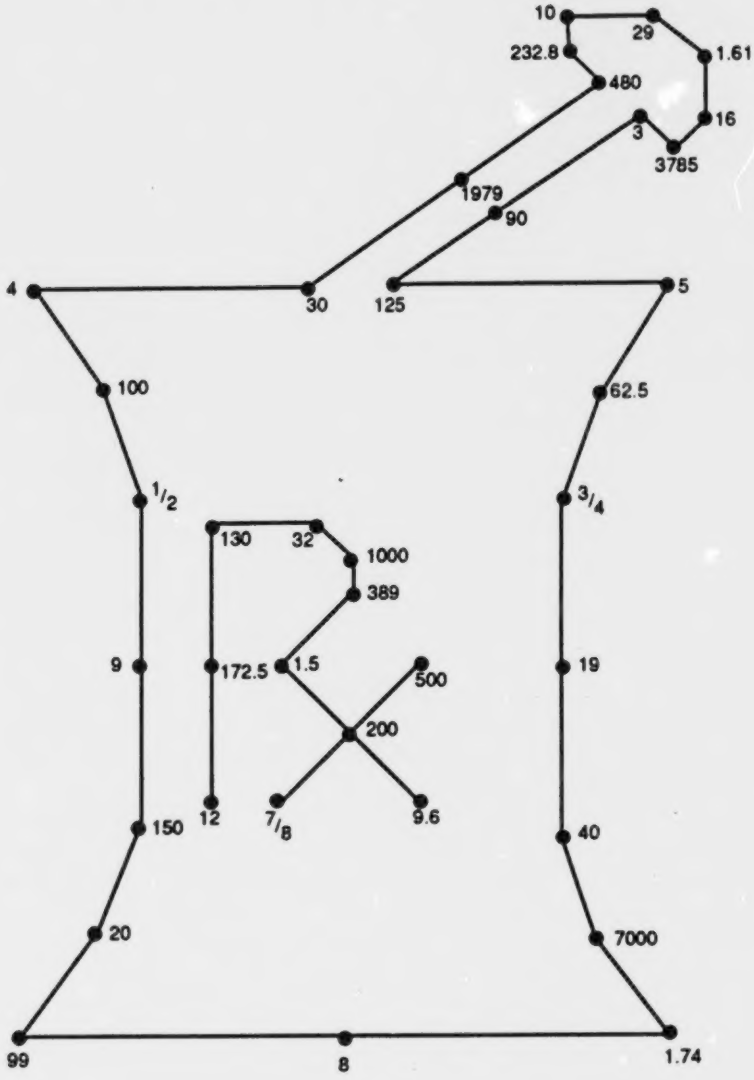
1. science of weights and measures
2. apothecary, avoirdupois, metric, common household
3. metric
4. a. ♏
   b. ƒʒ
   c. ƒ℥
   d. ℈
   e. ʒ
   f. ℥
   g. oz
   h. ℔
   i. lb
   j. pt
   k. g
   l. m
   m. l
   n. kg
   o. mg
5. common fractions, decimal fractions, ratios, percentages
6. a. representations of parts of a whole
   b. fractions in which the fractional part is expressed in multiples of ten
   c. the relationship between two substances with respect to the number of times one is contained in the other
   d. parts per hundred
7. (1) hecto, (2) deca, (3) no answer, (4) deci, (5) centi, (6) milli

Learning Activity 2: Conversions

1. a. L
   b. X
   c. 5
   d. XIX
   e. 74
   f. D
   g. 2001
   h. CXVII
   i. 564
   j. 99
2. a. 2
   b. 437 1/2
   c. 3
   d. 1,000
   e. 10
   f. 1,000
   g. 0.001
   h. 5
   i. 100
   j. 473
   k. 2.2
   l. 65
   m. 454
3. a. 0.05%
   b. 0.01%
   c. 0.4%
4. a. 75:1,000
   b. 1:100,000
   c. 25:1,000

Learning Activity 3: Using Measurement Systems

1. 4
2. 10 gr
3. 99
4. 9 g
5. 172.5
6. 8 oz
7. 12
8. 200 ml
9. 150 cm
10. 480 gr
11. 20 gr
12. 16 oz
13. 40%
14. 3/4
15. 1/2
16. 5
17. 90
18. 1,000 ml
19. 19
20. 389 g
21. ml
22. 7/8
23. 130 mg
24. 62.5 mg
25. 232.8"
26. 29
27. 7,000
28. 32 pt
29. 100
30. 125
31. $9.60
32. 1.5 g
33. 500 mg
34. $1.74
35. 1,000
36. 1,979
37. 3,785 ml
38. 3


10
29
232.8
1.61
480
3
16
3785
1979
90
4
30
125
5
100
62.5
1/2
3/4
130
32
1000
389
9
172.5
1.5
500
19
200
150
12
7/8
9.6
40
20
7000
99
8
1.74

Learning Activity 4: Projects for More Advanced Study

1. Flash cards should be evaluated by the instructor before use. Presentation should also be evaluated.
2. Areas of metric measure should include foodstuff, medicines, film, thermometers, car parts, tools, etc. The report must be evaluated for completeness by the instructor.
3. The report should include the development of the metric system in France, location of the standards, movement toward metrics in the United States, and a listing of countries using and not using the system.

UNIT 8 / Managing a Pharmacy

Learning Activity 1: Characteristics of a Good Employee

Evaluation should be to the instructor's satisfaction.

Learning Activity 2: Building Vocabulary

1. d
2. c
3. a
4. c
5. b
6. c
7. b
8. b
9. a
10. c

Learning Activity 3: Management and Data Processing

1. Answers will vary but should include those areas discussed in the manual.
2. to provide a large enough group of applicants that qualified people can be hired
3. orientation
4. performance appraisals, personal judgments
5. because the attitudes and behavior of the pharmacist and the other pharmacy workers are relayed to the consumer/patient
6. the people who work there
7. to satisfy the customer's needs and to make a profit
8. hardware, software, and auxiliary equipment
9. Hardware consists of a central processing unit, a keyboard, and a screen or display.
10. to allow a computer to communicate or to add auxiliary functions
11. modem
12. mainframe, minicomputer, microcomputer
13. The mainframe requires special environmental conditions and wiring, but it has the largest memory. The other two have less memory but do not require special conditions.
14. Answers will vary but will probably be a personal computer or microcomputer.
15. a. central processing unit
    b. personal computer
16. patient profiles, flagging for allergies, third-party information
17. inventory control; time management; preparing labels, letters, and bills; completing calculations; flagging or shutdown for violations of stop-order policy
18. Third-party information refers to insurance coverage. The first party is the purchaser. The second party is the insurer. The third party is the supplier or pharmacy.
19. a listing of a person's medical information and drug history

Learning Activity 4: Projects for More Advanced Study

1. Report should be completed to the satisfaction of the teacher.
2. Report should be checked for completeness. At least two examples of each area should be given.
3. Report should be completed to the satisfaction of the teacher.
4. Functions should include billing, preparation of patient profiles, time management, inventory control, flagging for special conditions such as allergies, and others specific for that pharmacy. A pharmacist must receive all prescriptions sent by computer. Other functions will vary with the pharmacy.
5. The summary should describe the skills taught and the type of computer used. The instructor should evaluate for accuracy.
6. Answers will vary with the facility.

UNIT 9 / Names, Sources, and Dosages of Drugs

Learning Activity 1: Definitions of Terms

A. 1. absorption—entry of drug into the bloodstream from the site of administration
   2. allergy—an antigen-antibody response that can result in danger to the patient
   3. chelating agent—an agent that is able to tie up metallic ions in the body
   4. diagnostic—a material used in establishing the cause of a disease
   5. dosage form—form in which drugs are dispensed to a patient/customer
   6. enzyme—a biochemical catalyst necessary for many biochemical reactions to take place
   7. metabolite—a compound formed in the body from another chemical
   8. side effect—a secondary effect of a drug, which may be beneficial or harmful
   9. toxicity—adverse side effects because of too much drug
   10. vaporizer—a device to change liquids into a vapor or spray

B. 1. agonist—a drug that reacts with a receptor to initiate a response
   2. antagonist—a drug that reacts with a receptor to prevent a physiological activity
   3. contraindication—a symptom or circumstance that makes a particular treatment or procedure inadvisable
   4. indication—a symptom or circumstance that indicates the advisability of a specific medical treatment or procedure
   5. receptor—a specific cell constituent with which a drug interacts to produce its effects
   6. symptom—any manifestation of an illness or a condition experienced by an individual
   7. syndrome—a set of symptoms and signs that occur together with reasonable consistency, characterizing a particular abnormality

Learning Activity 2: Scrambled Terms

1. absorption
2. metabolism
3. dosage form
4. capsule
5. solution
6. symptom
7. mechanism
8. agonist

Learning Activity 3: Prescription Drugs

1. chemical, generic, and trade
2. the manufacturer
3. one chemical, one generic, many trade names
4. a substance extracted from a source and used as it is; morphine, insulin, penicillin
5. A semisynthetic drug is produced by chemically adding to or subtracting from a natural product.
6. by mouth, topically, in suppositories
7. to mask a bad taste and to keep the tablet from dissolving in the stomach
8. coating to keep the tablet from dissolving before it reaches the intestines
9. to prolong the release of medication into the blood
10. by mouth, by injection, or topically
11. solutions, syrups, suspensions, emulsions, elixirs, tinctures
12. age, size, disease state, time of administration, route of administration, fate of the drug

13. In infants, the sensitivity to drug effects is usually much greater than in adults. Their body systems are not fully developed.
14. one hour before meals or two hours after meals
15. liver, kidneys
16. The actions of drugs are the processes by which the chemical constituents of the drug produce responses in living organisms. The response or reaction is the effect.
17. The desired therapeutic effect is the primary effect. The secondary effects are the other effects produced by the drug, either desirable or undesirable.
18. side effects
19. local—reacts at the site of application
    systemic—must be absorbed into the bloodstream before it exerts its action
20. contrast media, radioisotopes
21. none
22. The risks of a drug's use are compared to its benefits.

Learning Activity 4: Advanced Study about Drugs

The following answers are minimum suggestions. The reports should be expanded.

1. Lasix dosage forms—oral solution, tablets, injection
   Description—diuretic indicated for use in edema and hypertension
   Contraindications—those with anuria and those allergic to furosemide
   Cautions—causes tinnitus and hearing impairment, dehydration, blood volume depletion, and electrolyte depletion; gout and lupus may be activated
2. a. aspirin
      dosage form—tablet, suppository, caplet, capsule, timed-release capsule
      description—acetylsalicylate
      actions and indications—pain-reliever, antipyretic, antacid, upset stomach, heartburn, colds, flu, muscle aches, menstrual pain, toothache, sleeplessness due to pain, prevention of myocardial infarction
      contraindications—children with chicken pox or flu symptoms, pregnancy, allergic response to aspirin, sodium-restricted diet, and continued, unrelieved pain
   b. bulk laxative
      dosage form—tablet, wafer, powder
      description—bulk-forming fiber, either natural or man-made
      indication—management of temporary or chronic constipation, diverticulosis, after hemorrhoid surgery
      actions—absorbs water to form gelatinous bulk
      contraindications—fecal impaction, intestinal obstruction
   c. antiparasitic for scabies infestation
      dosage form—cream, lotion
      description—ectoparasiticide and ovicide against scabies
      indications—patients infested with scabies
      action—absorbed into parasites and ova
      contraindications—infants, anyone with a seizure disorder, sensitivity to the medication, nursing mothers
      caution—avoid contact with the eyes
3. Examples of chelating agents are BAL in Oil Ampules, Calcium Disodium Versenate
   Dosage forms: injection, Cuprid Capsules, Cuprimine Capsules, Depen Titratable Tablets, etc.

Examples of indications are listed below:
Bal in Oil—promotes excretion of arsenic, gold, mercury, and lead
Calcium Disodium Versenate—reduces blood levels and stores of lead in the body
Cuprid Capsules—treatment of Wilson's disease to aid excretion of copper from the body

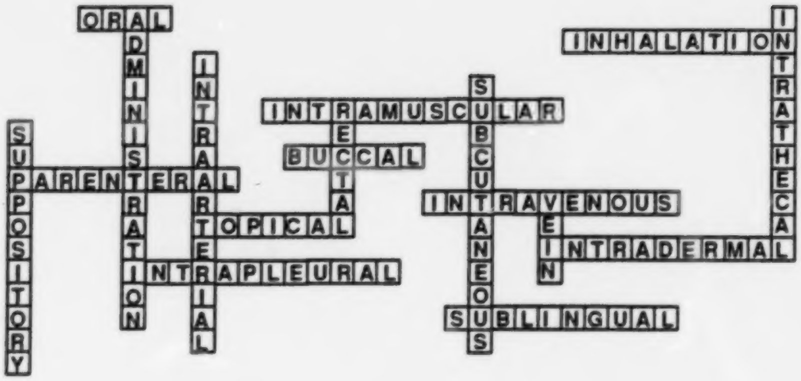
4. Examples of antimetabolites are Imuran Injection; Imuran Tablets; Purinethol; and Thioguanine, Tabloid Brand, etc.
   Examples of indications are listed below:
   Imuran Injection and Tablets are used to prevent rejection in renal transplantation and management of severe rheumatoid arthritis.
   Purinethol in tablets is used in treatment of acute lymphatic leukemia and acute myelogenous leukemia.
   Thiognanine, Tabloid Brand, is used in treatment of acute nonlymphocytic leukemia.
5. Examples of timed-release medications are 8-Hour Bayer Timed-Release Aspirin (pain relief and antipyretic), Fastin Capsules (treatment of obesity), and Erythromycin Capsule (bacterial infections), etc. Answers will vary. Instructors should check for accuracy.

UNIT 10 / Routes of Administration

Learning Activity 1: Questions about Drug Routes

1. the manner in which medications are applied or introduced into the body
2. a drug's chemical properties, a drug's physical properties, site of desired action, rapidity of response desired, patient's general condition
3. oral administration
4. lack of absorption problems, exact dosing of drug, irritating solutions can be used, large volumes can be introduced
5. Intravenous drugs are delivered into veins, while intra-arterial drugs go into arteries.
6. into the bone marrow
7. pediatrics, gerontology, emergency room, oncology (treatment area for cancer)
8. to ensure that it enters the central nervous system, since many drugs do not reach the CNS when given by any other route
9. intraspinal
10. enormous surface of absorbing tissue, rapid absorption, useful in emergency situations, drug gets to the desired site of action immediately
11. membranes lining body passages and cavities opening to the outside
12. a. peritoneum—the membrane lining the abdominal cavity and covering the viscera
    b. pleura—membrane covering the lungs
    c. CNS—central nervous system, the brain and spinal cord
13. by swabbing on the surface, instilling, spraying, or administering by douche, irrigation, or suppository

Learning Activity 2: Word Puzzle


ORAL
ADMINISTRATION
INTRA-ARTERIAL
INHALATION
INTRATHECAL
SUBCUTANEOUS
INTRAMUSCULAR
RECTAL
BUCCAL
SUPPOSITORY
PARENTERAL
INTRAVENOUS
VEIN
TOPICAL
INTRADERMAL
INTRAPLEURAL
SUBLINGUAL

Learning Activity 3: Advantages of Routes (Projects for More Advanced Study)

The format by which this material is presented may vary depending upon the agreement between student and instructor.

1. buccal—drug held between the cheek and gum until dissolved and absorbed
   adv.—rapid absorption
   disadv.—limited to certain drugs
   ex.—cough drops
2. intra-arterial—injection of drug into an artery
   adv.—localized action of the drug
   disadv.—drug cannot be recalled, must be sterile, must be in solution
   ex.—anticancer drugs, diagnostics
3. intradermal—injection of drug into the skin itself within cutaneous layers
   adv.—used for diagnostic agents
   disadv.—drug cannot be recalled, must be sterile, must be in solution, specialized route for diagnostics
   ex.—skin tests for allergies
4. intramuscular—injection of drug into muscle tissue
   adv.—rapid absorption with aqueous solutions; slow, even absorption with oil suspension; irritating substances may be used
   disadv.—to avoid intravenous injection, those of other parenteral injections
   ex.—penicillin
5. intrathecal—injection of drug into cerebrospinal fluid
   adv.—ensures that drugs will reach central nervous system
   disadv.—difficult, requires great care, those of other parenteral administration
   ex.—anesthesia for childbirth, antibiotics for CNS
6. rectal—placing medication into the lower rectum for absorption
   adv.—used when patient is vomiting, unconscious, or unable to take drugs by mouth
   disadv.—slow and irregular absorption, inconvenient
   ex.—aspirin suppositories, antiemetics
7. subcutaneous—injection of drug under the skin
   adv.—slow, even, prolonged drug absorption
   disadv.—skin sloughing with irritating drugs; those of other parenteral administration
   ex.—insulin

8. sublingual—drug held under the tongue until dissolved and absorbed
   adv.—rapid absorption
   disadv.—limited to certain drugs
   ex.—nitroglycerine
9. topical—administered directly on the skin or mucous membranes
   adv.—drug applied directly to site of action
   disadv.—slow absorption
   ex.—antiseptic cream, lotions, hand lotions
10. transdermal—use of dermal patches applied to the body
   adv.—constant, even drug flow over long period of time
   disadv.—slow absorption rate
   ex.—scopolamine patch, nitroglycerine patch

UNIT 11 / Cardiovascular Drugs

Learning Activity 1: Recognizing Terms and Definitions

1. a. arteriole—smallest type of artery
   b. artery—major blood vessel carrying blood away from the heart
   c. capillary—smallest blood vessel, connecting the arteriole and venule
   d. lymphatic system—part of the vascular system composed of lymph, lymph nodes, and lymphatic vessels
   e. vein—major blood vessel carrying blood to the heart
   f. venule—minute vein connecting capillaries with veins
2. (1) angina pectoris—chest pain associated with insufficient oxygen supply to the heart muscle
   (2) arrhythmia—abnormal, irregular heartbeat
   (3) bradycardia—slow heart rate of less than 60 beats per minute
   (4) hypertension—persistent, elevated blood pressure
   (5) hypotension—low blood pressure
   (6) tachycardia—rapid heart rate of more than 100 beats per minute
3. a. cardiovascular—pertaining to the heart and blood vessels
   b. extracellular—outside the cell
   c. intracellular—within the cell
   d. renal—pertaining to the kidneys
4. (1) adrenaline—mediator for nerve impulses in the adrenergic nervous system
   (2) angiotensin—constricts blood vessels
5. (1) diastole—relaxation of the heart
   (2) systole—contraction of the heart
6. (a) diuretics, (b) edema
7. (a) coagulation, (b) thrombus
8. a portion of the peripheral nervous system responsible in part for blood pressure

Learning Activity 2: Medication Effects

1. (1) bringing a continual supply of nutrients and oxygen to cells
   (2) removing waste products
   (3) maintaining normal balance between intracellular and extracelluar chemicals
2. heart, arteries, arterioles, capillaries, venules, veins, blood, and the lymphatic system
3. (1) changes heart rate (propranolol)
   (2) changes force of heart's contractions (digitalis)
   (3) regulates rhythm (lidocaine, procainamide, quinidine)

4. hypertension, congestive heart failure
5. The top number is the systolic pressure; the bottom number, the diastolic pressure.
6. either (1) systolic and diastolic—diastolic is most common, or
   (2) essential (primary) and secondary—essential is most common
7. No. Treatment is aimed at returning the blood pressure to as near normal as possible to prevent complications.
8. heart attack, stroke, blindness, kidney failure
9. furosemide, bumetamide, indapamide
10. No. All antihypertensives will cause some vasodilation to lower the blood pressure.
11. epinephrine, norepinephrine, metaraminol, methoxamine
12. heparin, coumadin, warfarin, dipyridamole, ticlopidine (any three)
13. It is for parenteral use only, and therefore only on inpatients.
14. vitamin K

Learning Activity 3: Classes of Drugs (Projects for More Advanced Study)

1. Evaluated to the satisfaction of the instructor.
2. Answers will vary by facility.
3. Students must list heart, arteries, arterioles, capillaries, venules, veins, blood, and lymphatic system. More detail may be included. Examples of drugs will vary.
4. Examples of drugs and their costs will vary with the facility.

UNIT 12 / Gastrointestinal Drugs

Learning Activity 1: Associating Terms and Definitions

1. b
2. d
3. c
4. a
5. c
6. d
7. a
8. c
9. b

Learning Activity 2: Questions about Drugs

1. to act on food materials mechanically and chemically
2. an acid secreted by special cells in the stomach
3. The HCl released may damage the mouth and teeth.
4. aids in the digestion and absorption of fats and fat-soluble vitamins
5. antacids
6. Anticholinergics block cholinergic responses to slow down increased acid secretion.
7. atropine, methantheline, propantheline, isopropamide iodide, glycopyrrolate, oxyphenonium, dicyclomine (any two)
8. dilated pupils, blurred vision, dry mouth, urinary retention, increased blood pressure, palpitations
9. GI smooth muscle relaxants
10. Different histamine receptors are involved.
11. as a syrup
12. diphenoxylate, loperamide

Learning Activity 3: Treatment of Gastrointestinal Complaints

1. anthelmintics
2. antiemetics
3. antidiarrheals
4. antiemetics
5. antacids, anticholinergics, histamine receptor blockers

Learning Activity 4: Classes of Drugs (Projects for More Advanced Study)

1. Scrapbook should be completed to the satisfaction of the instructor.
2. Answers will vary by facility.
3. a. digestant—(1) promoter or aid in digestive process, (2) supplements or (3) replaces digestive elements
      HCl—increases stomach acidity; e.g., betaine HCl, glutamic acid
      bile, bile acids, bile salts—from the liver for digestion and absorption of fats and fat-soluble vitamins; e.g., dehydrocholic acid, desoxycholic acid
      digestive enzymes—digestion of specific food components; examples should include natural enzymes such as pepsin and the commercially available ones such as pancreatin, diastase, and papain
   b. anticholinergics—control acetylcholine-mediated nerve impulses through secretion of acetylcholine; system controls salivation, GI secretion and motility; problems with side effects; e.g., atropine, methantheline, propantheline, etc.
      histamine receptor blockers-blocks the secretion of histamine to control gastric secretion of HCl; e.g., Tagumet
   c. emetics—induce vomiting in the case of poisoning by acting on the stomach itself or the brain center; e.g., saline solution, ipecac, apomorphine
   d. antiemetics—used to stop nausea and vomiting by acting on the brain centers; used to treat motion sickness; e.g., cyclizine, trimethobenzamide, etc.
   e. antidiarrheals—used to control excessive, watery bowel movements due to toxins, drugs, diet, or diseases; e.g., diphenoxylate, loperamide, and other OTC drugs
   f. anthelmintics—used to rid the body of parasitic, helminthic worms; helminthicide; e.g., mebendazole, pyrvinium pamoate
4. Examples of drugs and their costs will vary with the facility. Students should supply data to support their estimation of costs.
5. Answers will vary when students add medications from their pharmacies. Students should list the drugs by name with the structure affected. The following classes of drugs from the unit should be included.
   stomach—HCl, anticholinergics, histamine receptor blockers, emetics, antiemetics
   intestines—digestive enzymes, weak anticholinergics, antidiarrheals, anthelmintics
   liver—bile salts

UNIT 13 / Respiratory Drugs

Learning Activity 1: Recognizing Terminology

1. g
2. k
3. b
4. i
5. e
6. j
7. d
8. f
9. a
10. c
11. h

Learning Activity 2: The Respiratory System

1. the continual process of exchanging oxygen for carbon dioxide
2. Interruption for a few minutes or sometimes a few seconds can cause irreversible tissue damage and, eventually, death.
3. nose—passage for air to and from lungs
   throat—passage for air to and from lungs
   larynx—voice box
   trachea—windpipe
   bronchi—branches off trachea, passageway into lungs
   bronchioles—small branches of bronchi
   alveoli—sacs on ends of smallest bronchioles where gas exchange occurs
4. epiglottis
5. medulla oblongata
6. blood pH, percentage of carbon dioxide and oxygen in the blood, blood temperature, drugs
7. morphine and caffeine
8. anticough drug
9. adrenergics—epinephrine, isoproterenol, ephedrine, metaproterenol, terbutaline
   xanthines—theophylline, dyphylline, oxtriphylline
10. asthma prophylaxis to prevent the release of histamine and other substances that cause symptoms of an asthmatic attack
11. inhalation of dry powder

Learning Activity 3: Classes of Drugs (Projects for More Advanced Study)

1. Evaluated to the satisfaction of the instructor.
2. Answers will vary by facility.
3. a. antitussives—used to reduce the activity of the cough reflex; depresses medullary centers of brain to stop coughing; e.g., hydrocodone
   b. adrenergic bronchodilators—dilate bronchioles in the treatment of allergic bronchospasm; side effects include vasoconstriction, increased blood pressure, tachycardia; e.g., epinephrine, isoproterenol, ephedrine, metaproterenol, terbutaline
   c. xanthine bronchodilators—relax smooth muscles controlling the bronchi and bronchioles; e.g., theophylline, dyphylline, oxtriphylline
4. Examples of drugs and their costs will vary with the facility. Students should supply data to support their estimations of cost.

UNIT 14 / Nervous System Drugs

Learning Activity 1: Recognizing Terminology

1. a. axon—nerve fiber; part of the nerve cell that conducts impulses from the cell body
   b. dendrite—the branching portion of a neuron that conducts impulses to the cell body
   c. cell body—transmits nerve impulses from dendrite to axon
2. Afferent means *toward*, while efferent means *from* the central nervous system.
3. a. convulsion—a violent, involuntary muscle contraction or a series of such contractions producing jerking movements
   b. mania—an emotional disorder characterized by a state of excitement, hyperactivity, and profuse and rapidly changing ideas
   c. narcolepsy—frequent uncontrollable need for short periods of sleep
   d. seizure—an attack; the sudden onset of a disease or symptoms, especially epilepsy

4. a. analgesic—a drug that relieves pain
   b. anesthetic—a drug that produces partial or total loss of sensation or feeling
   c. hypnotic—a drug that induces sleep
5. interneuron, interconnects other neurons within the CNS
6. meninges
7. synapse
8. Homeostasis is the body's tendency to maintain internal stability. Irritability and conductivity enable the body to maintain it. Irritability is the ability to respond to stimuli. Conductivity is the ability to transmit those stimuli by means of nerve impulses.

Learning Activity 2: The Nervous System

1. CNS is the brain and spinal cord. PNS is the rest of the nervous system.
2. The brain is the center for all higher mental processes, emotions, sensations, and consciousness, and is the regulatory center for all bodily activities.
3. The spinal cord conducts nerve impulses from the periphery to the brain and from the brain to peripheral organs. It serves as a reflex center for reflexes that do not require the brain.
4. dendrite, cell body, axon
5. Motor neurons transmit impulses away from the higher centers and end in muscles or organs; sensory neurons transmit impulses from the periphery to the higher centers; and the internuncial neurons interconnect with other neurons.
6. central nervous system stimulants, central nervous system depressants
7. amphetamines, methylphenidate hydrochloride (Ritalin)
8. treatment of narcolepsy, suppression of appetite, calming of some hyperactive children
9. Eating foods with tryptophane or tyramine can cause hypertensive crisis and strokes.
10. a. caffeine in coffee, tea, and cocoa
    b. opium alkaloids from poppy

Learning Activity 3: Narcotics and Anesthesia

1. L-dopa is used for Parkinson's disease. Methyldopa is used for hypertension.
2. A sedative calms; a hypnotic puts to sleep. The same drug can be both, depending on the dose.
3. because of the possibility of habituation and dependence
4. Parkinson-like symptoms
5. They are potent painkillers and, in some cases, anti-inflammatory.
6. ibuprofen, indomethacin, naproxen, tolmetin, phenylbutazone, oxyphenbutazone, sulindac (any three)
7. general—produce a total loss of sensation and permit major surgery; local—produce a localized loss of sensation that permits minor procedures to be performed
8. either inhalation and parenteral or volatile and nonvolatile
9. to give enough muscle relaxation for deep abdominal or chest surgery
10. local anesthetic
11. lithium
12. L-dopa
13. glutethimide, methyprylon, chloral hydrate, paraldehyde, methaqualone (any two)
14. sleep, Librium, Valium
15. tranquilizers
16. analgesics

Learning Activity 4: Recognition of Medications

1. k
2. c
3. e
4. f
5. d
6. b
7. g
8. i
9. f
10. e
11. b
12. a
13. g, k
14. c
15. k
16. l
17. a
18. i
19. l
20. h
21. j
22. j

Learning Activity 5: Classes of Drugs (Projects for More Advanced Study)

1. a. *epilepsy*—should include a discussion of the range of types from petit to grand mal seizures; should explore causes such as infections, brain lesions, brain defects, metabolic disturbances, toxins, or trauma; should comment on idiopathic epilepsy; should describe anticonvulsant drugs used in therapy
   b. *narcolepsy*—should include a description of the recurrent attacks of drowsiness and sleep; should connect it to epilepsy; should list the drugs used for treatment
   c. *Parkinson's disease*—should describe the spreading tremor, muscular weakness, rigidity, gait, and facial mask; should describe both chronic and abrupt onset; should list drugs used in treatment and their purposes
2. Three examples each of cerebral stimulants, convulsant stimulants, and antidepressants are expected.
3. Three examples each of anticonvulsants, antiparkinson agents, sedative-hypnotics, antianxiety agents, antipsychotic agents, and narcotic analgesics are expected.
4. Answers will vary with the facility.
5. Report should discuss the early history of opium, the present geographical areas where it is cultured; the Opium Wars; early medical use; and present problems with abuse of its fractions.
6. Costs will vary with the pharmacy. Student should present data to support calculated costs.
7. This list will vary by facility.
8. Lists will vary depending on whether originating in a hospital or a community pharmacy.

UNIT 15 / Hormones

Learning Activity 1: Terms Relating to Endocrine Glands

1. *Hyper* means too much or a high amount. *Hypo* means not enough or a low amount.
2. specialized cells in the pancreas that secrete insulin
3. substance produced by an endocrine gland or a drug that simulates some other part of the body to increase activity or secretion
4. a. androgenic steroid—hormone from the adrenal cortex that stimulates the development of male characteristics
   b. glucocorticoid—hormone from the adrenal cortex that protects against stress and affects protein and carbohydrate metabolism
   c. mineralocorticoid—hormone from the adrenal cortex that affects the retention or excretion of sodium and potassium
5. gonads
6. glycogen
7. anabolism

Learning Activity 2: The Endocrine Glands

1. Exocrine glands secrete through ducts opening onto the skin or the GI tract. Endocrine glands secrete directly into the blood or lymph.
2. regulate metabolism, enhance growth and development, alter nervous system function
3. replace missing hormones, supplement deficient hormones, treat diseases, relieve symptoms, alter bodily function or condition
4. GH (STH), TSH, FSH, LH (ICSH), LTH, ACTH
5. LTH, LH, FSH, from the pituitary
6. vasopressin (ADH), oxytocin
7. dried (desiccated) thyroid, sodium levothyroxine (Letter, Synthroid), sodium liothyronine (Cytomel), thyroglobulin (Proloid), and liotrix (Euthroid, Thyrolar) (any three)
8. glucocorticoids, mineralocorticoids, androgenic steroids
9. insulin
10. hypoinsulinism or diabetes mellitus
11. Juvenile onset and adult onset are two types of diabetes mellitus. In juvenile onset, insulin is not being produced by the pancreas. In adult onset diabetes mellitus, the pancreas is secreting, but not enough for the body's needs.
12. Hypoglycemics are used to lower elevated blood sugar by promoting secretion of insulin. Examples of hypoglycemics are tolbutamide (Orinase), tolazamide (Tolinase), acetohexamide (Dymelor), and chlorpropamide (Diabinese).
13. development of sex organs, development and maintenance of secondary sex characteristics, skeletal development
14. estradiol (Dimenformon), estrogenic substances (Premarin), chlorotrianisene (TACE), and dienestrol (Synestrol)
15. prepare and maintain uterine lining for implantation and nourishment of the embryo, supplement estrogenic actions, suppress ovulation
16. progesterone (Progestin), hydroxyprogesterone (Delalutin), medroxyprogesterone (Provera), and norethindrone (Norlutin)
17. development of male sex organs, development of secondary sex characteristics in the male, metabolism of muscle and skeletal protein, storage of inorganic ions
18. testosterone (Delatestryl), methyltestosterone (Metandren), methandrostenolone (Dianabol), and stanozolol (Winstrol)

Learning Activity 3: Glandular Secretions and Functions

Gland	**Hormone**	**Basic Function**
testes	testosterone	development of secondary sex characteristics in males
ovary	estrogen	development of secondary sex characteristics in females
pancreas	insulin	carbohydrate metabolism
anterior pituitary	ACTH	controls synthesis and release of hormones from adrenal cortex
adrenal (cortex)	cortisone	carbohydrate, fat, and protein metabolism
thyroid	thyroxine	basal metabolic rate
thyroid	triiodothyronine	basal metabolic rate
parathyroid	parathormone	controls blood calcium levels
posterior pituitary	vasopressin (ADH)	responsible for salt and water metabolism

Learning Activity 4: Classes of Drugs (Projects for More Advanced Study)

1. Answers will vary with the pharmacy.
2. Cost estimates will vary, but students must submit a copy of all calculations.
3. Reports will vary but must include the following basic information.
    a. goiter—enlargement of the thyroid due to infection, tumors, glandular function, or lack of iodine in the diet. Exophthalmic goiter should be described. Geographic implications due to lack of iodine in the diet should be included. Treatment may be dietary, hormonal, or surgical.
    b. Addison's disease—results from a decreased secretion of hormones from the adrenal cortex. The condition causes weakness, weight loss, increased pigmentation of skin and mucous membranes, nausea, vomiting, and disturbances in the water and salt balance. It may be chronic or have acute phases. Hormone must be supplied as treatment.
    c. Cushing's syndrome—condition with excessive secretion of glucocorticoids from the adrenal cortex. It may be caused by tumors, steroids, hormone overmedication, or stimulation by the pituitary gland. Symptoms are obesity or edema, hair growth, skin discoloration, easy bruising, muscle weakness, osteoporosis, and elevated blood sugar.
    d. myxedema—atrophy or hypofunction of the thyroid in adults, causing edema of face, thickened skin, dry hair, and physical and mental lethargy. Treatment is hormone replacement or diet supplements if due to iodine lack.
    e. cretinism—occurs in newborns due to lack of thyroid activity. Mental and physical development are retarded. Children have potbellies and swaybacks. The condition must be treated with thyroid preparations early in life.
    f. acromegaly—hypersecretion of hormones from the anterior pituitary in adults. The condition results in enlargement of bones of the extremities and face, muscular pains and weakness, and eventual development of diabetes in some people. Treatment is with surgery and radiation.
4. Both types of diabetes are characterized by polyuria, polydipsia, hyperglycemia, and inadequate production or utilization of insulin. Insipidus is associated with a lack of a pituitary hormone, while mellitus results when the pancreas does not secrete enough insulin. Complications may be acidosis and/or coma. Chronic complications include cardiovascular and renal disorders, blindness, and ulceration due to poor healing. Treatment includes a balanced diet, exercise, weight control, and insulin therapy.
5. thymus gland—located in chest above heart, produces thymosin, regulates white cell development, prominent in children but shrinks with aging
   pineal gland—located between the parts of the thalamus, produces melatonin, probably regulates the gonads but exact function is unknown
6. Drawings should be done to the satisfaction of the instructor.
7. Routes of administration should include oral and parenteral. The insulin pump should also be mentioned. Examples will vary.

UNIT 16 / Drugs for Infectious Diseases and Cancer

Learning Activity 1: Using Terms Correctly

1. antibiotic—drug derived from microorganisms
2. antineoplastic—antitumor agent; most often an anticancer drug
3. bacteria—microscopic, single-cell organisms
4. crystalluria—presence of crystals in the urine

5. fungus—class of microorganisms; microscopic plants that differ from bacteria since they reproduce by means of spores; may be unicellular or multicellular
6. infectious disease—disease caused by a pathogenic organism
7. malignant—cancerous growth that spread, growing worse, and resisting treatment
8. metastasize—spread
9. neoplasm—tumor
10. pharmacokinetics—the study of the metabolism and action of drugs with emphasis on the time required for absorption, duration of action, distribution in the body, and method of excretion
11. prophylaxis—measures designed to preserve health and prevent disease
12. tubercle—lesion of tuberculosis
13. virus—extremely small infectious parasite invisible with an ordinary light microscope

Learning Activity 2: Sulfa Drugs and Antibiotics

1. bacteria, viruses, rickettsiae, protozoa, fungi, worms, and others
2. Bacteriostatic drugs inhibit from reproducing. Bactericidal drugs kill.
3. Do not prescribe indiscriminately. Take large enough doses long enough to wipe out infection. Make sure the drug is appropriate for the type of organism. Use in combination whenever possible.
4. Septra and Bactrim
5. sulfonamides
6. by inhibition of cell synthesis, inhibition of protein synthesis, and/or interference with the functions of the cell membrane
7. Narrow-spectrum antibiotics are useful against only a few organisms, while broad-spectrum antibiotics are useful aginst a wider range of microorganisms.
8. penicillin
9. an enzyme produced by certain bacteria that renders penicillin inactive
10. Some are destroyed in the stomach.
11. Dairy products interfere with tetracycline absorption.
12. Antacid products interfere with tetracycline absorption.
13. aminoglycosides
14. penicillin
15. tetracyclines
16. It is very toxic and can cause aplastic anemia in patients.

Learning Activity 3: Tuberculosis, Fungus, Malaria, and Cancer

1. the disease's complex pathology and physiology, resistance to antitubercular drugs
2. high rates or reinfection, difficulty of applying the antifungal agents to the sites of infection, time required for the treatment to be effective
3. the infecting organism, the stage the infection has reached, and the drug effective against the protozoan at that phase in its development
4. A benign tumor doesn't spread and is not as serious. A malignant tumor grows worse, spreads, and resists treatment.
5. to cure the disease, prolong patient survival time, and/or make the patient more comfortable
6. The drugs damage normal cells as well as cancer cells, producing many serious side effects.
7. alkylating agents, antimetabolites, antibiotics, plant alkaloids, hormones, miscellaneous antineoplastic agents
8. Antineoplastic antibiotics are much more toxic to the host.
9. d
10. c

11. b
12. c
13. d
14. a
15. b

Learning Activity 4: Infectious Disease Drugs

1. e
2. a
3. e
4. b
5. a
6. b
7. c
8. a
9. d
10. e
11. b
12. e
13. c
14. a
15. b

Learning Activity 5: Classes of Drugs (Projects for More Advanced Study)

1. Answers will vary but must meet with the approval of the instructor.
2. The four species of malariae sporozoin are Plasmodium vivax, P. falciporum, P. malariae, and P. ovale. The parasites are transmitted through the bites of infected female Anophales mosquitoes or by infected blood transfusions. The incubation period varies with the species. The parasites undergo both a sexual and an asexual cycle within the mosquito. They invade RBCs in the human. Chills, fever, and sweats accompany the human infection and cause anemia and an enlarged spleen. Treatment drugs are chloroquine phosphate and combinations of quinine, pyrimethamine, and a sulfonamide.
3. Penicillin was discovered by Fleming in England in 1945. It was derived from strains of Penicillium, a greenish or blue-green mold. Chain and Floury aided in its development.
4. Tuberculosis is caused by Mycobacterium tuberculosis, an acid-fast, rod-shaped bacteria. Usually, it infects the respiratory system but may be found in other body systems. Individuals may be infected with any of the three forms—human, bovine, and avian. The disease is characterized by abscesses, fibrosis, necrosis, and formation of tubercles. It may be acute or chronic. The disease progress may be arrested or active. Treatment includes chemotherapy, bed rest, and surgery.
5. The number of fungal diseases and the method of presentation should be reached by agreement between student and teacher. Fungal diseases for study may include tinea, candida, coccidiosis, histoplasmosis, blastomycosis, etc.
6. Heat, antiseptics, disinfectants, and anti-infectants should be included. Whether these kill or stop bacterial growth should be discussed.

UNIT 17 / Nonprescription Medications in the Pharmacy

Learning Activity 1: Self-Medication

1. ancient and traditional folk remedies
2. 40 million
3. $6 to 9 billion
4. 300,000/500
5. h
6. e
7. d
8. c
9. a

10. j
11. b
12. g
13. f
14. i
15. Knowledgeable patients who care for their own minor illnesses demand less of the more formal and more expensive system of health care. Physicians can concentrate on the diagnosis and treatment of more severe illnesses.
16. (1) ability to recognize the symptoms of minor, self-limiting illnesses for which self-medication is appropriate
    (2) ability to select the OTC product that will alleviate symptoms
    (3) ability to properly administer the proper dosage at the proper intervals
    (4) ability to recognize when to discontinue self-medication and consult a doctor
17. (1) to identify safe and effective ingredients for OTC drug products
    (2) to establish acceptable combinations of ingredients and their rationale for inclusion in products
    (3) to define safe and effective dose ranges for the ingredients in OTC products
    (4) to determine indications for self-medication use that are therapeutically acceptable as the manufacturer claims
    (5) to determine the information to appear on the OTC product labels, including indications, directions for use, and appropriate warnings and cautions
    (6) to develop acceptable testing methods for each pharmacological category of ingredients to determine safety and effectiveness
18. (1) brand name
    (2) dosage instructions
    (3) active ingredients
    (4) symptoms for treatment
    (5) cautions
    (6) possible side effects
    (7) when to contact a physician
    (8) name and address of the manufacturer
19. They should not judge it on the basis of having seen it advertised on television.

Learning Activity 2: Projects for More Advanced Study

1. Chart is to be completed to the satisfaction of the instructor.
2. The student must define both *OTC* and ***prescription***, explain what is required for a prescription, list requirements for labeling of OTC products, and name examples of each.
3. Lists will vary.
4. Costs will vary with the products selected.

UNIT 18 / Nonprescription Gastrointestinal Products

Learning Activity 1: Using Terms Correctly

1. diarrhea—frequent passage of watery bowel movements
   gastritis—inflammation of the gastric mucosa
2. alkalosis—condition in which the alkalinity of the body tends to increase beyond normal
3. intestinal flora
4. adsorbent—a substance that readily absorbs
   antacid—an agent that reduces and neutralizes acidity
   cathartic—producing bowel movements
   opiates—habit-forming drugs derived from opium
5. Feces is body waste, and flatus is gas.

6. Defecation is the normal evacuation of the bowels, and diarrhea is the frequent passage of many watery stools.
7. toxin
8. a. alkalinization
   b. acid rebound
9. Peristalsis is the wavelike movement in the GI tract that moves the contents of the intestines through and out. Regurgitation is opposite in direction and returns solids or fluids to the esophagus or mouth from the stomach.
10. (a) palatable (b) systemic

Learning Activity 2: Antacids

1. sour stomach, acid indigestion, upset stomach, heartburn, and many other symptoms of gastrointestinal distress
2. by taking medication on a full stomach or with milk
3. indigestion due to overeating, gastritis, esophageal regurgitation, and various types of gastrointestinal ulcers
4. to reduce or neutralize acid in the stomach
5. liquid or suspension
6. one hour after meals
7. with tetracycline antibiotics
8. sodium bicarbonate, calcium carbonate, aluminum hydroxide, magnesium hydroxide, magaldrate, and simethicone
9. Patients on low-sodium intake (especially congestive heart failure and hypertensive patients) should select low-sodium antacids.
10. antiflatulent
11. neutralizing capacity, intended use, palatability, low sodium content if other disease is present

Learning Activity 3: Antidiarrheal and Laxative Products

1. (a) Acute diarrhea is caused by toxins, drugs, or diet.
   (b) Infectious diarrhea is caused by bacteria (most common in adults) or viruses (most common in children).
2. They disrupt the normal intestinal bacterial flora.
3. *Salmonella, Shigella,* and enteropathic *E. coli*
4. viral diarrhea
5. diet, other systemic or local infections, medication
6. It changes the bacterial flora of the gastrointestinal tract.
7. adsorbents, opiates, anticholinergics or antispasmodics, lactobacillus preparations
8. kaolin and pectin
9. activity and movement of the GI tract
10. use by people who must avoid strain during evacuation, use prior to radiological bowel examination, treatment of acute constipation
11. irregular bowel habits, faulty eating habits, stress, food and drugs, and organic conditions
12. It would be nonirritating and nontoxic, and would act only on the descending and sigmoid colon. It would act within a few hours to produce a normally formed stool and then cease action and permit the resumption of normal body activity.
13. (1) saline laxatives—magnesium citrate, magnesium sulfate, sodium phosphate, magnesium hydroxide, Evac-Q-Kit, Epsom salts, Fleet Phospho-Soda, Milk of Magnesia (any two)
    (2) stimulant laxatives—castor oil, bisacodyl, cascara, senna compounds, phenolphthalein, Dulcolax (any two)

    (3) bulk-forming laxatives—Metamucil, LA Formula, Effersyllium, Konsyl, Maltsupex (any two)
    (4) emollient laxatives—dioctyl sodium sulfosuccinate, dioctyl calcium sulfosuccinate, Colace, Surfak, Peri-Colace, Doxidan (any two)
    (5) lubricant laxatives—mineral oil, Haley's M-O
14. The nonabsorbable ions of the saline laxatives cause retention of water in the intestine. The increased pressure from the water increases motility.
15. The stimulant laxatives irritate the mucosa, which increases peristalsis.
16. Bulk-forming laxatives either dissolve or swell in the intestinal fluid, increasing bulk.
17. These laxatives act as surface-active agents to form emulsions of aqueous and fatty substances within the feces, thereby softening the stool; the emollients

Learning Activity 4: Projects for More Advanced Study

1. Answers will vary but should include those areas covered in the paragraph "Evaluating a Patient/Customer's Condition" in unit 18.
2.-4. Projects should be completed to the satisfaction of the instructor.
5. Student should provide a product name, cost, and a description of how the agent works. Areas to be addressed in the advertising campaign should be those mentioned in the paragraph "The Ideal Laxative" in the unit.
6. The chart will vary but should include the side effects and contraindications included in the *PDR*.

UNIT 19 / Analgesics

Learning Activity 1: Pain, Aspirin, and Other Analgesics

1. medicines that relieve pain
2. protective mechanism
3. fatigue, anxiety, fear, and anticipation of more pain
4. organic, psychogenic
5. A placebo is an inactive substance given as medication to satisfy a patient or as a testing control.
6. headache
7. a. tension headache—results in spasms and tightness experienced in the head and neck region
    b. sinus headache—restricted to the frontal areas of the head and behind or around the eyes; intensified when person bends over
    c. migraine headache —throbbing pain, lasting from several hours to one or more days; may be preceded by visual disturbances, numbness and tingling in the lips, face or hands, accompanied by nausea and vomiting
8. aspirin, acetylsalicylic acid
9. prostaglandin synthesis inhibition
10. analgesic, antipyretic, anti-inflammatory
11. hypothalamus in the brain and peripheral pain receptors
12. allergic reactions, gastric disturbances, ringing in the ears, interference with blood coagulation
13. aspirin
14. delay drug absorption, remove unabsorbed drug from stomach
15. If the person is unconscious and able to swallow, one or two glasses of milk should be given. Empty the stomach.
16. acetaminophen, salicylamide

17. brand-name tablets and capsules, generic tablets and capsules, buffered aspirin tablets, highly buffered aspirin solutions, enteric-coated aspirin tablets, timed-release aspirin tablets, aspirin suppositories
18. Regular-strength Tylenol is 325 mg of acetaminophen per tablet or capsule, and extra-strength is 500 mg per tablet or capsule.
19. aspirin formulated to dissolve in the more alkaline small intestine
20. the nature of the illness; history of hypersensitivity or other disorders; other medications being taken; and the effectiveness, formulation, and price of the product
21. a. antipyretic—agent that reduces fever
    b. hepatotoxin—a poison specific to liver cells
    c. inflammation—condition caused by injury to body tissue resulting in pain, swelling, redness, heat, and impaired movement

Learning Activity 2: Comparison of Analgesics
Answers to all four questions will vary with the student and the facility. All four projects should be evaluated for completeness and meet standards of the original agreement between student and instructor.

UNIT 20 / Allergy, Cough, and Cold Products

Learning Activity 1: Developing Vocabulary
1. c
2. d
3. a
4. d
5. b
6. c
7. b
8. c
9. b

Learning Activity 2: Symptoms and Treatments
1. autumn, midwinter, spring
2. acute viral infection
3. at least 120
4. rhinovirus
5. children from one to five years old
6. runny nose, nasal congestion, sneezing, pharyngitis, cough, fever, headache, malaise
7. drowsiness, dry mouth, constipation, and blurred vision
8. chlorpheniramine maleate, diphenhydramine, phenyltoloxamine citrate, pyrilamine maleate, pheniramine maleate, and brompheniramine maleate
9. They act as vasodilators, which help decrease edema and swelling of nasal mucosa.
10. Lie on a bed or sofa with the head tilted back over the edge. The drops should then be instilled into each nostril without touching the nasal surface with the dropper.
11. Too much nasal spray or drops used too often result in nasal rebound. The nasal membranes become even more congested as the effects of the decongestant wear off.
12. phenylephrine, naphazoline, oxymetazoline, xylometazoline, and levodesoxyephedrine and propylhexedrine
13. high blood pressure, heart disease, diabetes, thyroid disease, high fever, glaucoma
14. phenylephrine, phenylpropanolamine, and pseudoephedrine
15. It causes the expulsion of mucus or phlegm from the throat or lungs.
16. guaifenesin; ammonium chloride, and ipecac

17. Antitussives work on the central nervous system to depress the medullary centers in the brain to suppress the cough.
18. a productive cough
19. codeine phosphate, dextromethorphan hydrobromide, diphenhydramine
20. bacterial infection, result of postnasal drip
21. strep throat, scarlet fever, influenza, smallpox, measles, tonsillitis
22. Advise the patient to see a physician.

Learning Activity 3: Product Survey (Projects for More Advanced Study)

1. Twenty items must be included on the chart with product information and the symptoms each is intended to treat.
2. The student may select any product. The following categories are suggested.
    a. antihistamine, decongestant (topical or systemic) with an analgesic; student should check for high blood pressure, heart disease, diabetes, thyroid disease, high fever, and angina before making recommendation
    b. antitussive if chest congestion is nonproductive
    c. should be evaluated by a physician
    d. cannot recommend oral decongestant; can suggest an antihistamine
    e. antihistamine, decongestant, expectorant, or antitussive
3. Demonstration must include specific instructions and be completed to the satisfaction of the instructor.

UNIT 21 / Nutritional Supplements, Vitamins, and Minerals

Learning Activity 1: Basic Nutrition

1. organic substance essential for metabolism, development, and growth of the body
2. They are essential for the metabolism of other nutrients, such as proteins, carbohydrates, and fats. They aid in formation of body cells and hormones. They act as enzymes for the body's chemical reactions.
3. heavy smoking, using oral contraceptives, heavy drinking, being elderly, prolonged use of antibiotics, pregnancy
4. A, D, K
5. fat-soluble—A, D, E, K; water-soluble—the B vitamins and C
6. Recommended Daily Allowance
7. Hypervitaminosis is an excess of vitamins in the body, which can be harmful. Because the fat-soluble vitamins can be stored in the body, it is possible to build up an excess of them.
8. A coenzyme combines with an enzyme to activate it; e.g., thiamine, which is necessary for biochemical reactions, or niacin, which is responsible for electron transfer of hydrogen
9. a. vitamin A—whole milk, dairy products, eggs, liver, leafy green vegetables
    b. vitamin D—milk, egg yolk, liver, tuna, salmon, cod liver oil
    c. vitamin E—vegetable oils, margarine, whole-grain cereal and bread, wheat germ, liver, dried beans, green leafy vegetables
    d. vitamin K—green leafy vegetables, tomatoes, cauliflower, egg yolk, soybean oil, liver
10. vitamin K
11. the vitamin B complex
12. inorganic substance essential for the formation, growth, and regulation of the body
13. iron, calcium, copper, iodine, magnesium, phosphorus, potassium, zinc (any five)
14. a. 16.500003 to 25.400006 mg
    b. calcium (1 g) and phosphorus (1 g)

Learning Activity 2: Chemical Names

1. j
2. i
3. h
4. g
5. k
6. b
7. f
8. e
9. d
10. c

Learning Activity 3: Deficiency Diseases

1. d
2. b
3. c
4. a
5. d
6. d

Learning Activity 4: Functions of Vitamins and Minerals

1. a
2. k
3. j
4. b
5. i
6. c
7. d
8. g
9. e
10. h
11. h
12. a
13. d
14. e
15. b
16. g
17. c
18. f

Learning Activity 5: Product Survey and Comparisons (Projects for More Advanced Study)

The answers to questions 1 through 3 will vary with the facility and selections made by the student. The following information should be included in the studies of deficiency diseases required in question 4. However, the studies should be more detailed.

Beriberi

Signs and Symptoms: cardiovascular and neurological abnormalities

Etiology: deficiency of thiamine in diet; occurs in chronic alcoholics; occurs geographically in Orient, Philippines, Pacific islands, and rice-growing sections of U.S.A. due to consumption of highly polished rice; secondary deficiency due to malabsorption

Treatment: administer thiamine, and balance diet nutritionally

Pellagra

Signs and Symptoms: rash, diarrhea, thickening of skin over face, inflammation of small intestine, nausea, vomiting, central nervous system abnormalities

Etiology: deficiency or impaired absorption of niacin; deficiency of tryptophane proteins in diet; secondary to alcoholism, unusual diets, and being elderly

Treatment: adequate diet, supplementary vitamins, injection of vitamins when problems in absorption occur

Rickets

Signs and Symptoms: retarded growth, bowed legs, malformed teeth, protruding abdomen and large head in children; bone wasting in adults

Etiology: vitamin D deficiency, which affects absorption of calcium and phosphorus

Treatment: give vitamin D, expose to sunlight or ultraviolet artificial light, regulate diet

Scurvy

Signs and Symptoms: loss of appetite, pains in legs and joints, anemia, weakness, abnormal bleeding, abnormal formation of bones and teeth, impaired healing of wounds

Etiology: vitamin C deficiency caused by poor nutrition due to psychiatric illness, alcoholism, exotic diets, lack of fresh fruits and vegetables in diet of adults or infants

Treatment: administer vitamin C, add fruits and vegetables to infant's diet, balance adult's diet nutritionally

UNIT 22 / Products for the Skin

Learning Activity 1: Poison Ivy Products

1. the exposed parts of the skin
2. toxicodendrol, containing the active ingredient urushiol
3. roots, stems, leaves, and fruit
4. The rash ranges from transient redness to severe swelling, blister formation, and great itching. The affected area oozes and eventually dries and crusts.
5. (1) contact with smoke from the burning plant
   (2) touching contaminated clothing, tools, shoes
   (3) stroking an animal that has come into contact with the plant
6. protecting the damaged skin until the acute reaction subsides, preventing scaling and crusting, and relieving the itching
7. anti-inflammatory steroids
8. local anesthetics, antipruritic agents, antiseptics, and astringents
9. benzocaine, dibucaine, pramoxine, tetracaine (any three)
10. Cortaid, Dermolate, Lanacort, Cortef, Caldecort (any three)
11. a. astringent—an agent that has a constricting or binding effect
    b. dermatitis—inflammation of the skin
    c. erythema—redness of the skin
    d. pruritus—itching

Learning Activity 2: Burn Products

1. A burn is an injury to tissue resulting from overexposure to thermal, chemical, electrical, or radioactive agents.
2. (1) First-degree burns are superficial, and the damage is limited to the outer layer of the epidermis. The first-degree burn is characterized by reddening of the skin, which is caused by the dilation of small blood vessels. There is no blistering.
   (2) Second-degree burns are burns in which the damage extends into the second layer of skin, called the dermis. In second-degree burns, fluid escapes from the blood vessels into the outer layer of the skin, causing blistering.
   (3) Third-degree burns destroy the entire depth of the skin and some of the tissues below the skin. The tissues may be charred or coagulated.
3. thermal, chemical, electrical, radiation
4. The symptoms include pain, swelling, tenderness, and blistering of the skin. Severe sunburn over a large area of the body can produce malaise, nausea, vomiting, chills, and fever.
5. between 10 A.M. and 2 P.M.
6. a condition in which the skin reacts abnormally to light, especially ultraviolet light
7. With photosensitivity, there is usually no edema, and the skin eruptions often extend to areas that had no exposure.

8. the tetracyclines, hexachlorophene, thiazide diuretics, chlorpromazine
9. controlling the pain, cleanliness
10. It alleviates pain, reduces swelling and depth of injury, and promotes subsequent healing.
11. the therapeutic use of cold
12. (1) immersion of the area in cold water or ice, (2) local anesthetics, (3) a skin cleanser, (4) a topical antibiotic or antimicrobial agent
13. Staphylococci, Streptococci, Pseudomonas
14. benzocaine (Americaine, Solarcaine), dibucaine (Nupercainal), lidocaine (Xylocaine), butamben picrate (Butesin Picrate)
15. from 0.5 percent to 20 percent
16. An acute systemic toxicity may develop.
17. Ointments, because of the usually greasy base, are the least desirable. Sprays and aerosols deliver the medication in the least traumatizing manner and have a cooling effect. Lotions, in being rubbed on, may increase the pain.
18. Keep the area as cool and as clean as possible.

Learning Activity 3: Case Studies

1. A person can be exposed indirectly to the toxic resin from poison ivy by contact with the smoke from the burning plant. Ms. Roberts's body and hands were covered, leaving only her face exposed. You might suggest a local anesthetic or an antipruritic agent for use. She should be sure to wash the clothes she wore, as they also were exposed to the smoke.
2. Advise Ronnie to see a doctor because of the painful, extensive, second-degree burn and the possibility of an elevated temperature. He should be warned not to use any medication, especially a salve, before seeing a doctor.
3. Possible suggestions are anesthetic agents, an antipruritic agent, and an astringent if crusting is a problem.
4. Burow's solution is a local treatment for poison ivy or poison oak.
5. Her activities occur indoors, and she does not complain with swelling, only redness. You know that she takes achromycin, which is one of the tetracyclines and can cause photosensitivity. She needs to consult her physician. All you can offer is a local anesthetic or antipruritic agent if there is itching.

Learning Activity 4: Projects for More Advanced Study

1. Suggested treatments will vary with the pharmacy. The report should include the following information.

   acne—an inflammation of the sebaceous glands and hair follicles which begins with puberty with increased hormone secretions; characterized by comedones, papules, and pustules; face, neck, and shoulders are common sites; cysts and nodules may form leading to scarring; treatment includes cleansing, peeling, and regulation of diet.

   eczema—dermatitis caused by predisposing genetic or psychological factors or by external factors such as microorganisms, allergies, or chemicals; may be dry or have watery discharge; may develop papules, vesicles, pustules, scales, or crusts; may be chronic or may respond to treatment but reoccur; treatment depends on individual cause.

   impetigo—skin inflammation caused by *Streptococci* or *Staphylococci*; occurs mostly on children on the face; forms vesicles which can become pustules and crusted; treatment is with antibiotics; crusts may be removed by soaks.

2 and 3. Studies will vary with the facility.

UNIT 23 / Weight Control Products

Learning Activity 1: Scrambled Terms

1. diet aid
2. hypothalamus
3. phenylpropanolamine
4. obesity
5. overweight
6. calorie
7. anorectic
8. anorexia

Learning Activity 2: Types and Treatments of Obesity

1. (1) The government's OTC advisory review panel recognized the safety and effectiveness of phenylpropanolamine.
    (2) A negative attitude toward the use of amphetamines has been developed by the public, physicians, and the FDA.
    (3) The image of diet aids has improved.
2. 20 to 30 percent
3. Endogenous weight is caused by an abnormality within the body. Exogenous weight is caused by excessive food intake.
4. (1) fat cell theory—number of fat cells determined in infancy
    (2) infantile obesity theory—adult obesity due to an excessive number of fat cells during infancy
    (3) adult-onset theory—obesity is due to an enlargement of fat cells, rather than an increased number
    (4) genetic component theory—children with obese parents have a better chance of becoming obese
    (5) environmental influence theory—widespread advertising contributes to obesity
    (6) psychogenic component of obesity theory—a psychogenic component is present in 90 percent of cases of obesity
5. shorter life expectancy, adult-onset diabetes, hypertension
6. the cerebral cortex
7. The hypothalamus apparently controls the appetite.
8. 3,500 calories
9. TOPS (Take Off Pounds Sensibly), Weight Watchers
10. a medication used for appetite control
11. because of their potential for abuse and dependence
12. phenylpropanolamine (PPA), benzocaine, bulk-producing agents, caffeine
13. 37.5 mg per dose, up to 75 mg per day
14. nervousness, tachycardia, increase in blood pressure, dizziness
15. in patients with diabetes, hypertension, hyperthyroidism, and heart disease
16. as an oral nasal decongestant
17. to produce numbness in the mouth
18. by producing a sense of fullness
19. to help overcome the fatigue associated with dieting
20. glucose, low-calorie foods, artificial sweeteners, fad diets, dieting, exercise
21. motivation and self-discipline, proper exercise, reduced caloric intake, OTC diet aids as needed

Learning Activity 3: Product Survey

1. Evaluated to the satisfaction of the instructor.
2. Volume and arrangement of collection must be satisfactory to the instructor.
3. Role-playing may be evaluated by other members of the class. Written report should be to the satisfaction of the instructor.

UNIT 24 / Health Care Accessories

Learning Activity 1: Supplies and Accessories

1. to periodically dust all the stock
2. so older stock will be used first before it goes out of date
3. wound dressings, absorbents, bandages, adhesive tapes, protectives
4. a product with the ability to take in moisture; cotton, gauze
5. Dressings cover wound surfaces. Bandages hold dressings in place.
6. a product that adds to the convenience or effectiveness of something
7. cushions, trusses, urology supplies, ostomy supplies, thermometers, inhalers and atomizers, hypodermic equipment, syringes, home health care accessories
8. supports for patients with hernias
9. a. an operation in which parts of the intestinal or urinary tract are removed
   b. an artificial opening created during surgery
10. (1) ostomy that produces solid waste at the stoma; requires a detachable, throwaway pouch with a large gasket opening
    (2) ostomy that produces only urine; requires a permanent device cemented to skin and having a drain
    (3) ostomy that produces semisolid waste; appliance cements to skin or on a belt with a waterproof seal, both types open at the bottom
11. oral-type thermometer with slender bulb
    rectal-type thermometer with blunt, strong, pear-shaped bulb
    universal-type with short, stubby bulb
    electronic thermometer used at hospitals; with a display, probes, and sheaths
    digital display, located on a probe
    disposable paper thermometer
12. 29 1/2 to 13 (must be in this order)
13. walker, walker-cane combination, rolling walker
14. hospital, adjustable aluminum, offset, quad
15. for extra stability
16. axillary for short-term help, Canadian or Lofstrand for long-term help

Learning Activity 2: Projects for More Advanced Study

Answers will vary with the stock available in each facility.

Tests

TEST / UNIT 1

Careers in Pharmacy

Directions: Answer the following questions.

1. What is pharmacy?

2. What does a pharmacist do?

3. What does a pharmacy technician do?

4. From where did the word *pharmacy* come?

5. Identify the following occupations.

   a. apothecary

   b. chymist

   c. druggist

6. Differentiate between pharmaceutical chemistry and pharmacy administration.

7. Which branch of pharmacy would a person study to learn about drugs derived from natural substances?

8. List the two major career fields for pharmacists.

   (1)

   (2)

9. List four opportunities that may motivate workers in individually owned and chain pharmacies.

   (1)

   (2)

   (3)

   (4)

10. List four career opportunities for pharmacists other than community and institutional pharmacy.

(1)

(2)

(3)

(4)

11. Give the meaning of (a) OBRA 90 and (b) DUR, and explain how they are related.

TEST / UNIT 2

Ethics and Customer-Patient Relations

Directions: Answer the following questions.

1. By what common bond are all pharmacists bound together?

2. Explain the purpose of laws.

3. Explain why ethics are important.

4. What organization provides the code of ethics generally recognized by most pharmacists?

5. From what area of activities in a pharmacy does the pharmacist dissociate him- or herself as much as possible?

6. Select one word to describe the relationship between pharmacist and customer.

7. Describe the guidelines to remember for creating a friendly, professional atmosphere in a pharmacy.

8. What kinds of knowledge can the pharmacist share with the prescription patient?

9. What two factors make working in pharmacies different from other retail businesses?

   (1)

   (2)

10. Describe several things to do to help ease the situation when handling complaints from customers.

TEST / UNIT 3

Drug Legislation

Directions: Write answers to the following questions.

1. Name the two federal agencies involved with pharmacy and drug regulations and enforcement.

   (1)

   (2)

2. Name the two state agencies (in Texas) involved with drug regulations and enforcement.

   (1)

   (2)

3. What is an OTC drug?

4. What is a controlled substance?

5. What is a legend drug?

6. If there is a conflict between state and federal law, which law will prevail?

7. List the categories of scheduled drugs.

8. What prescription files in pharmacies are required by law in Texas?

9. Do hospital inpatient drug records come under state law?

TEST / UNIT 4

Safety

Directions: Write answers to the following questions.

1. What is OSHA?
2. Discuss the importance of cleanliness in the pharmacy.
3. What is a laminar flow hood, and for what is it used?
4. What is the first thing you should do in case of a robbery?

Directions: Match each situation to the type of pharmacy hazard. There may be more than one answer for each situation.

Situation

_____ 5. falling off a ladder
_____ 6. dropping box on toe
_____ 7. entering TB patient's room
_____ 8. faulty equipment
_____ 9. water on floor from leaking air conditioner
_____ 10. exposed electric wire
_____ 11. oily rags in the storeroom by the water heater
_____ 12. gun pointed at you
_____ 13. corrosive spill
_____ 14. spraining back lifting an object
_____ 15. burned-out light bulb
_____ 16. cluttered walkway
_____ 17. wearing protective clothing
_____ 18. being stuck by a hypodermic needle

Type of Hazard

a. environmental
b. materials handling
c. fire
d. robbery

TEST / UNIT 5

Dispensing in the Pharmacy

Directions: Fill in the blanks with the proper word.

1. A ______________ is an order for a medicine or medicines by a licensed physician.

2. The ______________ part of a prescription consists of the written letters *Rx.*

3. The ______________ is a list of the ingredients and their quantities to be used in preparing the prescription.

4. The ______________ is the part of the prescription that contains the directions to the pharmacist for the manner of preparation of the ingredients into a form suitable for the patient.

5. The ______________ is the part of the prescription that consists of the directions to the patient.

Directions: Match each abbreviation to its term.

_____ 6. Rx
_____ 7. dr
_____ 8. 30cc
_____ 9. gr
_____ 10. gtt
_____ 11. o.s.
_____ 12. ac
_____ 13. p.r.
_____ 14. p.v.
_____ 15 q.o.d.
_____ 16 t.i.d.
_____ 17. o.u.
_____ 18. stat
_____ 19. ss
_____ 20. aa

a. each
b. rectally
c. vaginally
d. both eyes
e. grain
f. two tablespoonfuls
g. one tablespoonful
h. teaspoon
i. drop
j. left eye
k. three times daily
l. twice daily
m. "take thou"
n. before meals
o. every other day
p. at once
q. one-half
r. as needed
s. after meals
t. gram
u. once daily

Directions: Answer the following questions.

21. List the five rights that must always be considered when dispensing a medication.

    (1)
    (2)
    (3)
    (4)
    (5)

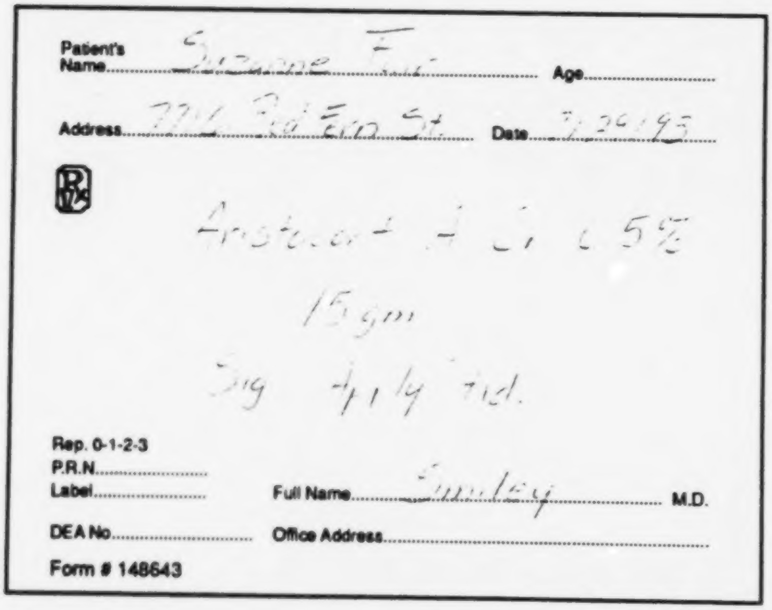
22. List the four information items required to refill a prescription.

    (1)
    (2)
    (3)
    (4)

23. What four items of information do you need to handle a transfer prescription?

    (1)
    (2)
    (3)
    (4)

24. Below the following prescription, write the directions as they would appear on a prescription label.



Patient's Name Suzanne F[illegible] Age

Address 772 Red Elm St. Date 7/20/95

℞

Aristocort A Cr 0.5%

15 gm

Sig Apply tid.

Rep. 0-1-2-3
P.R.N.
Label
Full Name Smiley M.D.
DEA No.
Office Address
Form # 148643

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TEST / UNIT 6

Materials Management

Directions: Write answers to the following questions.

1. List four of the questions that a pharmacy worker should keep in mind when checking in a delivery at the pharmacy.

    (1)

    (2)

    (3)

    (4)

2. Give the temperature ranges established by the U.S.P. for the following terms.

    a. cold

    b. room temperature

    c. excessive heat

3. Define the following terms.

    a. hermetic container

    b. single-dose container

    c. unit-dose container

    d. single-unit container

    e. multiple-unit container

    f. multiple-dose container

4. What type of lid must be placed on medication containers sold to customers?

5. What is a floor-stock drug distribution system?

6. What is a unit-dose distribution system?

TEST / UNIT 7

Metrology

Directions: Answer these questions.

1. Define *metrology.*

2. List four systems of measurement used in pharmacy.

   (1)

   (2)

   (3)

   (4)

3. Explain how calculations are reported in the following forms.

   a. common fractions

   b. decimal fractions

   c. ratio

   d. percentage

4. Fill in the following table.

	Arabic numeral	*Roman numeral*
a.	50	________
b.	10	________
c.	________	VII
d.	19	________
e.	________	LXIV
f.	500	________
g.	________	MMIII
h.	104	________
i.	________	DLXXIX
j.	________	XCIV

5. List the abbreviations of symbols for the following terms.

   a. minim

   b. fluidram

   c. fluidounce

   d. scruple

   e. dram

   f. meter

   g. liter

   h. kilogram

   i. milligram

   j. deciliter

6. Give equivalents in milliliters.

   a. 1 tablespoon

   b. 1 teaspoon

7. Fill in the following conversion table.
   a. 1 qt = _____ pt
   b. 1 ʒ = _____ ℈
   c. 1 kg = _____ g
   d. 1 l = _____ ml
   e. 1 kg = _____ lb

TEST / UNIT 8

Managing a Pharmacy

Directions: Answer the following questions.

1. Define *management.*

2. List the five functions of management.

    (1)

    (2)

    (3)

    (4)

    (5)

3. List five of the basic functions of an organization.

    (1)

    (2)

    (3)

    (4)

    (5)

4. What is *working capital?*

5. Explain what is meant by *data processing.*

6. What are the three components of a data processing system?

    (1)

    (2)

    (3)

7. Explain the purpose of peripheral devices.

8. Explain how a modem is used.

9. Name the three main types of computers.

   (1)

   (2)

   (3)

TEST / UNIT 9

Names, Sources, and Dosages of Drugs

Directions: Write answers to these questions.

1. List the names by which a drug may be identified.

2. What is the difference between a drug's generic name and its trade name?

3. Name two general sources of drugs.

4. Define these terms.

   a. agonist

   b. contraindication

   c. dosage form

   d. drug action

   e. drug effect

   f. side effect

5. Describe a tablet, and tell why it might be coated.

6. List three liquid dosage forms.

   (1)

   (2)

   (3)

7. List four factors that can modify the dose of a given drug.

   (1)

   (2)

   (3)

   (4)

8. Why should an infant patient not be merely considered a little adult and dosed only according to body weight?

9. Distinguish between local actions and systemic actions of drugs.

10. Give an example of a diagnostic.

11. What is meant by the term ***risk-to-benefit ratio*** for a drug?

TEST / UNIT 10

Routes of Administration

Directions: Write answers to these questions.

1. Describe the five considerations used to determine the best route of administration for a drug.

   (1)

   (2)

   (3)

   (4)

   (5)

2. Define *drug administration.*

3. List the seven general routes used for administration of drugs.

   (1)

   (2)

   (3)

   (4)

   (5)

   (6)

   (7)

4. How is parenteral administration carried out?

5. What is the preferred route of administration if no alternate routes have distinct advantages?

6. Explain how subcutaneous and intradermal administrations differ.

7. State the site for delivery of these types of drugs.

   a. intravenous

   b. intra-arterial

   c. intraosseous

   d. intrathecal

   e. intrapleural

   f. intraperitoneal

8. Describe how topical medications are administered.

9. What is a mucous membrane? By what route are drugs delivered to these membranes?

10. Differentiate between sublingual and buccal administration.

11. Why are medications administered through inhalation?

TEST / UNIT 11

Cardiovascular Drugs

Directions: Write answers to the following questions.

1. Name the parts of the cardiovascular system.

2. Describe three ways in which cardiac drugs affect the heart.

   (1)

   (2)

   (3)

3. Identify these abnormal conditions.

   a. tachycardia

   b. angina pectoris

   c. arrhythmia

   d. hypotension

4. Name two conditions that may be treated with renal drugs.

   (1)

   (2)

5. Name two preferred diuretics in hypertension treatment regimens.

   (1)

   (2)

6. What are two complications of untreated hypertension?

   (1)

   (2)

7. Name a drug used to elevate blood pressure.

8. Name two anticoagulants.

(1)

(2)

9. What is a thrombus?

10. What is the clotting vitamin?

TEST / UNIT 12

Gastrointestinal Drugs

Directions: Write answers to these questions.

1. What are the primary functions of the gastrointestinal system?

2. Name the natural chemical in the stomach that is needed for digestion.

3. Why should people be cautioned about chewing Acidulin tablets?

4. Why should deficiencies of bile, bile acids, or bile salts be treated?

5. How are anticholinergics useful in the treatment of peptic ulcers?

6. Name two side effects of atropine.

   (1)

   (2)

7. What class of drugs forms the mainstay of peptic ulcer therapy?

8. Name an anticholinergic useful in the treatment of ulcers.

9. Name a prescription-only product used to control diarrhea.

10. Define these terms.

    a. achlorhydria

    b. anthelmintic

    c. digestant

    d. emetic

    e. hypochlorhydria

TEST / UNIT 13

Respiratory Drugs

Directions: Write answers to the following questions.

1. What is respiration?

2. List the seven main parts of the respiratory system, and discuss their functions.

   (1)

   (2)

   (3)

   (4)

   (5)

   (6)

   (7)

3. What part does the medulla oblongata portion of the brain play in respiration?

4. What is an antitussive?

5. Name a brochodilator of the adrenergic class.

6. Name a bronchodilator of the xanthine class.

7. Name the prophylactic agent that is used in some asthmatic patients to prevent the release of histamine and other substances that cause the symptoms of an asthmatic attack.

8. How is cromolyn sodium administered?

TEST / UNIT 14

Nervous System Drugs

Directions: Place the correct answers in the blanks.

1. Antianxiety agents are also called ______________________________.
2. Pain-killing drugs are also called______________________________.
3. Food containing______________________________ can cause problems to patients taking monoamine oxidase inhibitor antidepressants.
4. The drug of choice in Parkinson's disease is ________________________.
5. A naturally occurring narcotic analgesic is ________________________.

Directions: Answer the questions.

6. What are the three parts of a neuron?

   (1)

   (2)

   (3)

7. Tell where these are located.

   a. synapse

   b. meninges

8. Name three types of neurons.

   (1)

   (2)

   (3)

9. What is narcolepsy?

10. Name a drug used in the treatment of hyperactive children.

11. Differentiate between seizures and convulsions.

12. What is the difference between a sedative and a hypnotic?

13. Why should antianxiety agents be used only for short periods of time?

14. Name and describe the two major types of anesthetics.

    (1)

    (2)

15. What class of drug is procaine (Novocaine)?

16. Identify the drug component used to treat manic depression.

TEST / UNIT 15

Hormones

Directions: Write answers for the following questions.

1. Differentiate between exocrine and endocrine glands.

2. List three physiological functions of hormones.

   (1)

   (2)

   (3)

3. Name the seven endocrine glands discussed in this unit.

   (1)

   (2)

   (3)

   (4)

   (5)

   (6)

   (7)

4. Which gland produces hormones to regulate the secretion of hormones in other glands?

5. Where are the islets of Langerhans located, and what is their function?

6. What is the name of the hormone secreted by the parathyroid gland, and what is its function in the body?

7. Name the three types of hormones secreted by the adrenal cortex.

    (1)

    (2)

    (3)

8. What is the major hormone that comes from the pancreas?

9. What disease is caused by a deficiency of insulin?

10. Name two types of diabetes mellitus.

    (1)

    (2)

11. What is the purpose of a hypoglycemic?

12. Name the gland that secretes each of the following hormones.

    a. estrogen

    b. progesterone

    c. androgens

TEST / UNIT 16

Drugs for Infectious Diseases and Cancer

Directions: Answer the following questions.

1. Differentiate between the following pairs of terms.
   a. bactericidal and bacteriostatic agents
   b. narrow-spectrum and wide-spectrum antibiotics
   c. anti-infectives and antineoplastic agents
   d. benign and malignant tumors
2. Explain what crystalluria is, and name the drug of which it might be an effect.
3. What are antibiotics?
4. How do antibiotics exert their effects?
5. What was the first antibiotic discovered?
6. What is penicillinase?
7. Why can't all penicillin derivatives be taken by mouth?
8. Name two antibiotics besides penicillin.
   (1)
   (2)
9. Which antibiotic causes both drug-food and drug-drug reactions?
10. What is a tubercle?

11. Discuss factors complicating the treatment of human fungal infections.

12. Name two antineoplastic agents.

    (1)

    (2)

13. What is the difference between antibiotics used for infectious disease and those used in the treatment of cancer?

TEST / UNIT 17

Nonprescription Medications in the Pharmacy

Directions: Answer the following questions.

1. How is self-medication an essential element in the health care delivery system?

2. What four things do the patient and the pharmacy worker need to consider regarding self-medication?

   (1)

   (2)

   (3)

   (4)

3. List and describe three pieces of regulatory legislation that have affected the use of over-the-counter medications.

   (1)

   (2)

   (3)

4. List the three categories by which all OTC drugs will be classified, with a brief definition of each.

   (1)

   (2)

   (3)

5. What information must be on an over-the-counter drug package label?

TEST / UNIT 18

Nonprescription Gastrointestinal Products

Directions: Fill in the blanks.

1. People usually use antacids to treat __________________.
2. Drug-induced indigestion can usually be alleviated by ______________________________.
3. The ________________ dosage form seems to be more effective than other dosage forms of antacids.
4. Drugs of the ______________ class cause diarrhea by disrupting the normal intestinal bacterial flora.
5. Antacids containing ________________ are also capable of provoking diarrhea.
6. Acute diarrhea in infants is often caused by ______________________________.
7. A laxative is a mild ______________ agent that enables the bowels to evacuate without pain.
8. The active ingredients of ____________________ are relatively nonabsorbable.
9. Stimulant laxatives increase the peristaltic activity of the intestine by irritation of the ______________________________.
10. The ________________ laxatives are natural and semisynthetic polysaccharides and cellusose derivatives which dissolve or swell in the intestinal fluid.
11. ____________________ laxatives act as surfactants, or surface-active agents.

Directions: Match the definitions with the terms.

_____ 12. an agent that will neutralize acidity
_____ 13. neutralizing the acid in the stomach
_____ 14. inflammation of the gastric mucosa
_____ 15. excessive gas in the digestive tract
_____ 16. overcompensation with the production of more acid
_____ 17. return of solids or fluids to the esophagus or mouth from the stomach
_____ 18. a condition in which the alkalinity of the body tends to increase beyond normal
_____ 19. affecting the body generally
_____ 20. pleasing to taste

a. alkalinization
b. alkalosis
c. antacid
d. acid rebound
e. flatulence
f. gastritis
g. palatable
h. regurgitation
i. systemic

Directions: Answer these questions.

21. When is the best time to take antacids?

22. What is the most significant drug-drug interaction involving antacids?

23. List three ingredients commonly found in OTC antacid products.

(1)

(2)

(3)

24. What is the major concern of congestive heart failure patients who need to use antacids?

Directions: Match the definitions with the terms.

_____ 25. evacuation of the bowels

_____ 26. body waste, such as food residue

_____ 27. frequent passage of watery bowel movements

_____ 28. bacteria normally found in the gastrointestinal tract

_____ 29. a progressive, involuntary, wavelike movement in the GI tract

_____ 30. adsorbent

_____ 31. a poisonous substance of animal or plant origin

_____ 32. pertaining to the whole body rather than to one of its parts

_____ 33. paregoric

a. intestinal flora

b. diarrhea

c. peristalsis

d. kaolin

e. opiate

f. defecation

g. toxin

h. systemic

i. feces

j. Lactinex

TEST / UNIT 19

Analgesics

Directions: Answer these questions.

1. Define the term ***analgesic***.

2. Discuss (a) the function of pain in the body, (b) what factors influence pain, and (c) the two main types of pain.

3. What is the most common type of pain?

4. When someone describes the symptoms listed below, what type of headache do you suspect?

   a. The pain is restricted to the frontal areas of the head and behind or around the eyes.

   b. The headache is characterized by intense throbbing pain, lasting for several hours to one or more days and accompanied by a visual disturbance.

5. What do recent studies indicate to be the mode of action of aspirin?

6. List the three primary effects of aspirin.

   (1)

   (2)

   (3)

7. List the four side effects of aspirin.

   (1)

   (2)

   (3)

   (4)

8. What is the purpose of emergency treatment for aspirin poisoning?

9. List two other analgesics found in nonprescription products.

   (1)

   (2)

10. Name four dosage forms of aspirin.

    (1)

    (2)

    (3)

    (4)

11. What is enteric-coated aspirin?

12. Define each of the following terms.

    a. placebo

    b. antipyretic analgesic

    c. extra-strength capsule

    d. hepatotoxic medication

TEST / UNIT 20

Allergy, Cough, and Cold Products

Directions: Answer the following questions.

1. What causes the common cold?

2. What is a rhinovirus?

3. Describe the symptoms of the common cold or allergies.

4. Explain how each of the following products acts on the body.

    a. antihistamine

    b. decongestant

    c. antitussive

    d. demulcent

5. What are some of the side effects of antihistamines?

6. For what kind of cough should you *not* recommend an antitussive?

7. Describe how to administer nose drops.

8. Describe the condition called *nasal rebound,* and tell what causes it.

9. What is pharyngitis?

10. Of what diseases besides a cold may pharyngitis be a symptom?

11. What should you recommend to a patient/customer who has had cold symptoms for more than two weeks?

TEST / UNIT 21

Nutritional Supplements, Vitamins, and Minerals

Directions: Fill in the blanks or answer the question.

1. What is a vitamin?

2. ______________ of the ten essential vitamins are water-soluble, and four are ___________.

3. The fat-soluble vitamins are ________________.

4. The water-soluble vitamins are ______________.

5. How does hypervitaminosis occur?

6. What does *RDA* mean?

7. What is a mineral?

8. The mineral necessary for the production of red blood cells is ___________________.

9. The mineral that helps to maintain electrolyte balance within the body is ________________.

10. The mineral required by the thyroid gland for its functioning is _______________________.

Directions: Match the following.

____ 11. retinol
____ 12. ergocalciferol
____ 13. tocopherol
____ 14. menadione
____ 15. ascorbic acid
____ 16. thiamine
____ 17. cyanocobalamine
____ 18. pyridoxine
____ 19. niacin
____ 20. riboflavin

a. pantothenic acid
b. vitamin B_1
c. vitamin B_2
d. vitamin B_3
e. vitamin B_6
f. vitamin B_{12}
g. vitamin K
h. vitamin E
i. vitamin D
j. vitamin A
k. vitamin C

Directions: Select the correct answer and write the letter in the blank.

_____ 21. Vitamin C deficiency disease
a. pellagra
b. beriberi
c. ricketts
d. scurvy

_____ 22. Vitamin K deficiency disease
a. pellagra
b. hypoprothrombinemia
c. macrocytic anemia (large red blood cells)
d. pernicious anemia

_____ 23. Folic acid deficiency disease
a. pellagra
b. hypoprothrombinemia
c. macrocytic anemia (large red blood cells)
d. pernicious anemia

_____ 24. Niacin deficiency disease
a. pellagra
b. hypothrombinemia
c. macrocytic anemia (large red blood cells)
d. ricketts

_____ 25. Vitamin B_1 deficiency disease
a. pellagra
b. hypoprothrombinemia
c. ricketts
d. beriberi

_____ 26. Vitamin B_{12} deficiency disease
a. pellagra
b. hypoprothrombinemia
c. macrocytic anemia
d. pernicious anemia

TEST / UNIT 22

Products for the Skin

Directions: Fill in the blanks with the correct word or words.

1. Poison ivy rash is an ______________________________, caused by direct contact with a specific agent.

2. The most common sites of poison ivy dermatitis are the ______________________________.

3. The poisonous resin toxicodendrol contains an active ingredient, ______________________________, which is responsible for poison ivy and poison oak dermatitis.

4. The causative agent is found in the ______________________________ of the plant.

5. Hyposensitization may be achieved by administration of ______________________________ either orally or by injection.

6. When the reaction to the poison ivy or poison oak dermatitis is severe, prescription-only ______________________________ are commonly administered.

7. Describe the symptoms of poison ivy and poison oak dermatitis.

8. What are the major objectives of treatment for poison ivy and poison oak dermatitis?

9. Name the four major types of ingredients common to over-the-counter products used for poison ivy dermatitis.

   (1)

   (2)

   (3)

   (4)

10. What are three indirect ways you can be exposed to poison ivy or poison oak?

    (1)

    (2)

    (3)

11. Name two commonly used local anesthetics in poison ivy products.

(1)

(2)

12. Name two of the most popular brands of hydrocortisone products now available over-the-counter.

(1)

(2)

13. You will sunburn faster between the hours of______________________________.

14. A bacteria that will colonize in a burned area is______________________________.

Directions: Match the terms to the definitions.

a. Achromycin
b. erythromycin
c. dibucaine
d. ampicillin
e. first-degree burn
f. second-degree burn
g. third-degree burn
h. radiation burn
i. thermal burn
j. anesthetic
k. erythema
l. blistering
m. photosensitivity
n. burn
o. Mycitracin

_____ 15. an injury to tissue resulting from overexposure to thermal, chemical, electrical, or radioactive agents

_____ 16. a burn injury characterized by reddening of the skin, which is caused by the dilation of small blood vessels

_____ 17. a burn injury that destroys the entire depth of the skin and some of the tissues below the skin

_____ 18. a condition in which the skin reacts abnormally to light

_____ 19. an agent used to help alleviate the pain associated with burns

_____ 20. a medication that has antipruritic action and relieves pain associated with burns

_____ 21. redness of the skin

_____ 22. a burn resulting from overexposure to sunlight

_____ 23. a common causative agent of drug-induced photosensitivity

Directions: Answer these questions.

24. What are the first two considerations in the treatment of all burns?

    (1)

    (2)

25. Why is cryotherapy used in the treatment of burns?

TEST / UNIT 23

Weight Control Products

Directions: Match the definitions to the terms.

_____ 1. an abnormal amount of fat on the body
_____ 2. condition of being 10 to 15 percent over normal weight
_____ 3. a theory that the number of fat cells is determined in infancy
_____ 4. theory that obesity is due to an enlargement of fat cells, rather than an increased number of cells
_____ 5. being full to satisfaction
_____ 6. area of the brain that controls response to visual and chemical stimuli
_____ 7. the lack or loss of appetite
_____ 8. medication to help overcome the fatigue associated with dieting
_____ 9. currently the most popular ingredient in over-the-counter diet aids
_____ 10. bulk-producing agent

a. phenylpropanolamine
b. benzocaine
c. carboxymethylcellulose
d. obesity
e. caffeine
f. overweight
g. anorexia
h. fat cell theory
i. adult-onset obesity theory
j. satiety
k. appetite center
l. cerebral cortex
m. saccharin
n. amphetamine
o. phenylephrine

Directions: Answer the following questions.

11. Differentiate between exogenous and endogenous obesity.

12. By what methods do TOPS and Weight Watchers help people to lose weight?

13. Name four of the six theories concerning the causes of obesity.

(1)

(2)

(3)

(4)

14. List the four major ingredients in over-the-counter diet control products.

(1)

(2)

(3)

(4)

15. Why is caffeine used in combination with phenylpropanolomine?

16. Name four other means of controlling weight besides OTC products.

(1)

(2)

(3)

(4)

17. Name the four components of any weight loss program for the average patient.

(1)

(2)

(3)

(4)

TEST / UNIT 24

Health Care Accessories

Directions: Write answers to the following questions.

1. What is the reason for placing new or fresh stock behind the old on pharmacy shelves?

2. Name three types of surgical or first-aid supplies.

   (1)

   (2)

   (3)

3. What is an accessory?

4. Name five health or prescription accessories besides the home health products. Briefly discuss the use of each.

   (1)

   (2)

   (3)

   (4)

   (5)

5. Define these terms.

   a. absorbent

   b. ostomy

   c. stoma

   d. truss

6. Give an example of each of these home health accessories.

   a. hospital thermometer

   b. cane

   c. crutch

Answers
to
Tests

UNIT 1 / Careers in Pharmacy

1. the art and science of dispensing natural and synthetic source medications for use in the treatment and prevention of disease
2. The pharmacist advises people in the use of medication and is responsible for the storing, preparing, and dispensing of drugs and medications prescribed by other health professionals.
3. stores, prepares, and dispenses drugs and medications under the direction of a pharmacist
4. from the Greek word ***pharmakon***
5. a. name given in former times to the physician-pharmacist
    b. nineteenth-century pharmacist
    c. nineteenth-century pharmacist
6. Pharmaceutical chemistry is concerned with the application of organic and inorganic chemistry to medications. Pharmacy administration deals with the practices of business and law as they apply to pharmacy.
7. pharmacognosy
8. community pharmacy, institutional (hospital) pharmacy
9. opportunities to serve the public, to have a responsible position in the community, improve public health, work with and earn respect of professionals and others in the pharmacy, and to make a living in a challenging field (any four)
10. drug wholesaling, research and manufacturing, pharmaceutical marketing and advertising, writing, teaching, and government service (any four)
11. a. Omnibus Budget Reconciliation Act of 1990
    b. Drug User Review
    The Act requires pharmacists to perform drug use reviews to detect and prevent problems with drug therapy.

UNIT 2 / Ethics and Customer-Patient Relations

1. concern for the health and well-being of the patient
2. Laws require correct behavior by a government.
3. Ethics are a set of moral principles or values that enable people to do good and avoid evil.
4. American Pharmaceutical Association
5. commercial
6. personal
7. Use the personal touch. Maintain a professional appearance. Be prompt and courteous.
8. proper administration of the medication, side effects, proper storage, the need to use up the prescription
9. Customers will be ill or have a member of the family who is ill; it is highly regulated and legally sensitive.
10. Listen carefully, and hear the person out. Let the person vent his or her irritation. Express your regret at any inconvenience the customer has experienced.

UNIT 3 / Drug Legislation

1. Food and Drug Administration (FDA), Drug Enforcement Administration (DEA)
2. State Board of Pharmacy, DPS
3. a drug that can be legally sold without a prescription
4. a drug or substance subject to the control of the Federal Drug Comprehensive Drug Abuse Prevention and Control Act of 1970

5. a drug that on the original container bears the federal legend that federal law prohibits dispensing without a prescription
6. the strictest law
7. Schedules I, II, III, IV, V
8. three files: (1) for all Schedule II drugs dispensed, (2) for Schedules III, IV, and V drugs dispensed, and (3) for prescription orders of all other drugs dispensed
9. yes

UNIT 4 / Safety

1. Occupational Safety and Health Administration
2. Cross-contamination with drugs can be a very serious health problem. The physical appearance can attract or turn away customers and patients.
3. A laminar flow hood is an apparatus producing very clean and dustfree areas. It is useful in the preparation of IV solutions.
4. cooperate with the robber
5. b
6. b
7. a
8. a
9. a
10. a, c
11. b, c
12. d
13. a, b
14. b
15. a
16. a, c
17. a, b
18. a, b

UNIT 5 / Dispensing in the Pharmacy

1. prescription
2. superscription
3. inscription
4. subscription
5. transcription
6. m
7. h
8. f
9. e
10. i
11. j
12. n
13. b
14. c
15. o
16. k
17. d
18. p
19. q
20. a
21. (1) the right patient, (2) the right drug or drugs, (3) the right dose, (4) the right route of administration, (5) the right intervals
22. the patient's name, the prescription number, the physician's name, the patient's phone number
23. the patient's name, the prescription number, the other pharmacy's phone number, the patient's phone number
24. Patient: Suzanne Fair
    Doctor: Smiley
    Aristocort A Cr. 0.5% 15 gr apply tid
    Apply 3 times daily.

UNIT 6 / Materials Management

1. Has the shipment arrived at the right place?
   Is the shipping container intact?
   Does the packing slip agree with the contents of the shipment?

Does the packing slip agree with the original purchase order?
Are all of the items in the shipment in good condition?
Have you missed anything? (any four of these)

2. a. cold—not over 8°C (46°F)
   b. room temperature—15° to 30°C (59° to 86°F)
   c. excessive heat—above 40°C (104°F)
3. a. a container impervious to air
   b. a single-unit container for articles intended for parenteral administration
   c. a single-unit container for articles intended for administration by other than the parenteral route
   d. a container designed to hold a quantity of drug intended for use as a single unit
   e. a container which permits the withdrawal of portions of the contents without changing the strength, quality, or purity or the remaining contents
   f. a multiple-unit container for parenterally administered drugs only
4. childproof
5. All drugs that will be used by the patients are kept at the nursing station. The stock is automatically replaced by the pharmacy when it runs low.
6. Unit-dose medications are ordered, packaged, handled, administered, and charged in units containing enough of the drug for one regular dose, application, or use.

UNIT 7 / Metrology

1. the science of weights and measures
2. apothecary, avoirdupois, metric, common household
3. a. represent parts of a whole
   b. fractions in which the fractional part is expressed in multiples of ten
   c. the relationship between two substances with respect to the number of times one is contained in the other
   d. parts per hundred
4. a. L
   b. X
   c. 7
   d. XIX
   e. 64
   f. D
   g. 2003
   h. CIV
   i. 579
   j. 94
5. a. ♏
   b. ƒʒ
   c. ƒ℥
   d. ℈
   e. ʒ
   f. m
   g. l
   h. kg
   i. mg
   j. dl
6. a. 15 ml
   b. 5 ml
7. a. 2
   b. 3
   c. 1,000
   d. 1,000
   e. 2.2

UNIT 8 / Managing a Pharmacy

1. series of activities directed toward achieving certain objectives
2. planning, organizing, directing, communicating, controlling
3. recruit employees, develop human resources, secure financial resources, acquire supplies and goods for sale, organize the capabilities of the human resources, meet the customer's or patient's needs, plan for growth (any five)
4. money to carry on the day-to-day activities of a business
5. the performance of clerical procedures by computers
6. hardware, software, auxiliary equipment
7. to allow computers to communicate or to add an auxiliary function
8. A modem is used to convert electronic signals from one form to another.
9. mainframe, minicomputers, microcomputers

UNIT 9 / Names, Sources, and Dosages of Drugs

1. chemical, generic, and trade
2. The generic name is the name approved for general use and is derived from the chemical name. The trade name is the name one specific manufacturer is allowed to use. A generic drug may have many trade names.
3. natural sources, synthetic sources, semisynthetic sources (any two)
4. a. agonist—a drug that combines with a receptor to produce an effect
   b. contraindication—symptom or circumstance that makes inadvisable a particular treatment or procedure
   c. dosage form—the form in which a drug is administered to a patient/customer
   d. drug action—the process by which drugs produce responses in living organisms
   e. drug effect—the observed responses to a drug's actions
   f. side effect—a secondary effect of a drug
5. ingredients are molded or compressed into a form; to mask a bad taste or to prevent the tablet dissolving in the stomach
6. solutions, syrups, suspensions, emulsions, elixirs, tinctures (any three)
7. dosage form, age, size, disease state, time, route, fate of drug (any four)
8. In infants, the sensitivity to drug effects is usually much greater than in adults. Their body systems are not fully developed.
9. Local actions occur at the site of administration, whereas systemic actions occur throughout the body wherever the blood transports the drug.
10. contrast mediums, radioisotopes (either one)
11. The risk of a drug's use must be compared to its benefits.

UNIT 10 / Routes of Administration

1. the drug's chemical properties, the drug's physical properties, the site of desired action, the rapidity of response desired, the patient's general condition
2. the manner in which medications are applied or introduced into the body
3. parenteral, topical, rectal, application to mucous membranes, sublingual, buccal, and inhalation
4. by means of a hollow needle
5. oral or by mouth

6. Subcutaneous drugs are delivered underneath the skin layer. Intradermal drugs are placed within the skin layer.
7. a. veins
   b. arteries
   c. bone marrow
   d. cerebrospinal fluid
   e. within the lung cavity
   f. into the abdominal cavity
8. applied to the skin surface or to mucous membranes
9. membranes lining body passages or cavities opening to the outside; by application
10. Sublingual refers to the placement of a drug beneath the tongue. In buccal administration, the drug is held between cheek and gum.
11. for rapid absorption, to get the drug to the desired site of action immediately

UNIT 11 / Cardiovascular Drugs

1. heart, arteries, arterioles, capillaries, venules, veins, blood, lymphatic system
2. changes heart rate, changes heart rhythm, changes force of heart's contractions
3. a. rapid heartbeat of greater than 100 per minute
   b. chest pain associated with insufficient oxygen supply to the heart muscle
   c. abnormal, irregular heartbeat
   d. low blood pressure
4. hypertension, congestive heart failure, edema (any two)
5. chlorothiazide, hydrochlorothiazide, chlorthalidone, quinethazone, metolazone (any two)
6. heart attack, stroke, blindness, kidney failure (any two)
7. epinephrine, norepinephrine, metaraminol, methoxamine, isoproterenol, dopamine (any one)
8. heparin, coumadin, warfarin, dipyridamole, ticlopidine (any two)
9. a clot formed within a blood vessel
10. vitamin K

UNIT 12 / Gastrointestinal Drugs

1. to act on food materials mechanically and chemically
2. cydrochloric acid (HCl)
3. The HCl released may damage the mouth and teeth.
4. They are important in the digestion and absorption of fats and fat-soluble vitamins.
5. to decrease HCl secretion
6. dry mouth, blurred vision, urinary retention, dilated pupils, increased blood pressure, palpitations (any two)
7. antacids
8. atropine, methantheline, propantheline, oxyphenonium, isopropamide iodide, glycopyrrolate
9. diphenoxylate (Lomotil), loperamide (Imodium) (either one)
10. a. achlorhydria—lack of hydrochloric acid
    b. anthelmintic—agent used to rid the body of parasitic worms
    c. digestant—agent that promotes or aids in the digestive process
    d. emetic—agent that induces vomiting
    e. hypochlorhydria—low amount of hydrochloric acid

UNIT 13 / Respiratory Drugs

1. continual exchange of oxygen and carbon dioxide
2. nose—passage for air to and from lungs
   throat—passage for air to and from lungs
   larynx—voice box
   trachea—windpipe
   bronchi—branches off trachea, passageway into lungs
   bronchioles—small branches of bronchi
   alveoli—sacs on ends of smallest bronchioles, where gas exchange occurs
3. location of the respiratory center in the brain
4. anticough drug
5. epinephrine, isoproterenol, terbutaline, metaproterenol (any one)
6. theophylline, dyphylline, oxtriphylline (any one)
7. cromolyn sodium (Intal, Aarane)
8. inhalation of dry powder

UNIT 14 / Nervous System Drugs

1. tranquilizers
2. analgesics
3. tryptophane or tyramine
4. L-dopa or levodopa (Larodopa)
5. opium alkaloids or morphine and codeine
6. dendrite, cell body, axon
7. a. synapse—point of contact between an axon and the dendrite of the next neuron
   b. meninges—membranes covering the brain
8. motor (efferent), sensory (afferent), internuncial (interneurons)
9. frequent uncontrollable need for short periods of sleep
10. methylphenidate hydrochloride (Ritalin)
11. A seizure is an attack or sudden onset of a disease or symptoms. A convulsion is a violent, involuntary muscle contraction or a series of contractions producing jerking movements.
12. They differ only in degree. The hypnotics are sleep-producing drugs, while sedatives are given for a calming effect.
13. They can cause habituation and physical dependence.
14. general—produce a total loss of sensation and permit major surgery; local—produce a localized loss of sensation that permits minor procedures to be performed
15. local anesthetic
16. lithium

UNIT 15 / Hormones

1. Exocrine glands secrete through ducts onto the skin or the GI tract. Endocrine glands secrete directly into the blood or lymph.
2. regulate metabolism, enhance growth and development, alter nervous system function
3. pituitary, thyroid, parathyroid, adrenal, pancreas, ovaries, testes
4. pituitary
5. pancreas, to regulate carbohydrate metabolism
6. parathormone, calcium concentration in the blood

7. androgenic steroid, glucocorticoid, mineralocorticoid
8. insulin
9. diabetes
10. juvenile onset, adult onset
11. to lower elevated blood sugar
12. a. ovaries
    b. ovaries
    c. testes

UNIT 16 / Drugs for Infectious Diseases and Cancer

1. a. Bactericidal agents kill, while bacteriostatic agents inhibit reproduction of bacteria.
   b. Narrow-spectrum antibiotics are useful against only a few organisms, while broad-spectrum antibiotics are effective against a wide range.
   c. Anti-infectives act against infectious disease. Antineoplastic agents act against tumors.
   d. Malignant tumors are cancerous growths that spread, grow worse, and resist treatment. Benign tumors are not malignant.
2. Crystalluria occurs when crystals are present in the urine. It occurs when sulfonamides are used.
3. drugs derived from microorganisms
4. inhibition of cell synthesis, inhibition of protein synthesis, and/or interference with the functions of cell membranes
5. penicillin
6. an enzyme produced by certain bacteria that renders penicillin inactive
7. Some forms are destroyed in the stomach.
8. tetracycline, cephalosporins, aminoglycosides, erythromycin, chloramphenicol, miscellaneous antibiotics (any two)
9. tetracycline
10. a lesion of tuberculosis
11. high rates of reinfection, difficulty of applying antifungal agents, the length of time required for treatment
12. alkylating agents, antimetabolites, antibiotics, plant alkaloids, hormones (any two)
13. The antibiotics used in fighting cancer are toxic to the host, so they cannot be used as anti-infectives.

UNIT 17 / Nonprescription Medications in the Pharmacy

1. Knowledgeable patients who care for their own minor illnesses demand less of the more formal and more expensive system of health care. Physicians can concentrate on the diagnosis and treatment of more severe diseases.
2. (1) ability to recognize symptoms of minor, self-limiting illnesses, (2) selection of the proper OTC product, (3) the patient's ability to take the medicine correctly, and (4) the patient's ability to recognize when to discontinue self-medication and consult a doctor
3. The student may select any three of the following:
   (1) The Pure Food and Drug Act (1906)—drugs must meet standards of strength and purity claimed by the manufacturer, and products containing opiates must say so on the label
   (2) The Sherley Amendment (1912)—manufacturers may not make false therapeutic claims about a product; difficult to enforce because burden of proof was placed on the government

    (3) The Food, Drug, and Cosmetic Act (1938)—new drug products must be approved as safe before marketing
    (4) The Durham-Humphrey Amendments (1951)—divided drugs into the two classes of prescription and nonprescription drugs
    (5) The Kefauver-Harris Amendments (1962)—manufacturer must establish safety and effectiveness of all drugs marketed after 1938
    (6) The NAS-NRC-FDA Drug Efficacy Study (1966)—under contract from FDA, National Academy of Sciences-National Research Council undertook evaluation of more than 3,400 new drugs that entered the market between 1938 and 1962, including 512 OTC drugs
    (7) The FDA OTC Drug Products Evaluation Program (1972)—FDA charged seventeen panels of experts to begin a review of active ingredients of all OTC drug products to evaluate their safety and efficacy
4. Category I—generally recognized as safe and effective for the claimed therapeutic indication
   Category II—not recognized as safe and effective
   Category III—additional data needed to decide the safety and effectiveness
5. brand name, dosage instructions, active ingredients, symptoms for treatment, cautions, possible side effects and interactions, when to contact the physician, name and address of the manufacturer

UNIT 18 / Nonprescription Gastrointestinal Products

1. indigestion
2. taking medication on a full stomach or with milk
3. liquid
4. antibiotics
5. magnesium
6. viral infections
7. cathartic
8. saline laxatives
9. mucosa of the intestinal smooth muscle
10. bulk-forming
11. emollient laxatives
12. c
13. a
14. f
15. e
16. d
17. h
18. b
19. i
20. g
21. one hour after meals
22. with tetracycline antibiotics
23. sodium bicarbonate, calcium carbonate, aluminum hydroxide, magnesium hydroxide, magaldrate, simethicone (any three)
24. sodium content of the antacid
25. f
26. i
27. b
28. a
29. c
30. d
31. g
32. h
33. e

UNIT 19 / Analgesics

1. analgesic—medication to relieve pain
2. a. protective mechanism
   b. fatigue, anxiety, fear, and anticipation of more pain
   c. organic, psychogenic
3. headache
4. a. sinus
   b. migraine
5. prostaglandin synthesis inhibition
6. analgesic, antipyretic, anti-inflammatory
7. allergic reactions, gastric disturbances, ringing in the ears, interference with blood coagulation
8. to delay drug absorption and to remove any unabsorbed drug from the stomach
9. acetaminophen, salicylamide
10. brand-name tablets and capsules, generic tablets and capsules, buffered aspirin tablets, highly buffered aspirin solution, enteric-coated aspirin tablets, timed-release aspirin tablets (any four)
11. aspirin formulated to dissolve in the more alkaline small intestine
12. a. inactive substance given as medication to satisfy a patient or as a testing control
    b. a pain-relieving drug that reduces fever
    c. a capsule with 500 mg of drug rather than 325 mg
    d. a medication that will poison liver cells

UNIT 20 / Allergy, Cough, and Cold Products

1. viral infection
2. a virus that affects the upper respiratory tract
3. runny nose, nasal congestion, sneezing, pharyngitis, cough, fever, headache, feeling of discomfort
4. a. antihistamine—blocks the actions of histamine at the histamine receptor site
   b. decongestant—constricts dilated arterioles and capillaries in swollen nasal passages
   c. antitussive—acts on CNS by depressing the medullary centers in the brain to suppress the cough
   d. demulcent—a soothing agent
5. drowsiness, dry mouth, constipation, blurred vision
6. productive cough
7. Lie on bed or sofa with head tilted back over the edge. The drops should be instilled into each nostril without touching the nasal surface with the dropper. Patient should remain in that position for about 5 minutes.
8. During nasal rebound, the mucous membranes become even more congested as the effects of the decongestant wear off due to the use of too much nasal spray or using drops too often.
9. sore throat caused by bacterial infection or continual postnasal drip
10. strep throat, scarlet fever, influenza, small pox, measles, tonsillitis
11. to see a physician

UNIT 21 / Nutritional Supplements, Vitamins, and Minerals

1. organic substance essential for metabolism, development, and growth of the body
2. six, fat-soluble
3. A, D, E, K

4. C and B-complex
5. when an excess of vitamins is stored in the body
6. Recommended Daily Allowance
7. inorganic substance essential for the formation, growth, and regulation of the body
8. iron
9. potassium
10. iodine
11. j
12. i
13. h
14. g
15. k
16. b
17. f
18. e
19. d
20. c
21. d
22. b
23. c
24. a
25. d
26. d

UNIT 22 / Products for the Skin

1. allergic contact dermatitis
2. exposed parts of the skin
3. urushiol
4. roots, stems, leaves, and fruit
5. Rhus antigen
6. anti-inflammatory steroids
7. ranges from transient redness to severe swelling, blister formation, and great itching
8. protecting the damaged skin until the acute reaction subsides, preventing scaling and crusting, and relieving the itching
9. local anesthetics, antipruritic agents, antiseptics, astringents
10. contact with smoke from the burning plant; touching contaminated clothing, tools, shoes; stroking an animal that has come in contact with the plant
11. benzocaine, dibucaine, pramoxine, tetracaine (any two)
12. Cortaid, Dermolate, Lanacort, Cortef, Caldecort (any two)
13. 10 A.M. and 2 P.M.
14. *Streptococci, Staphylococci, Pseudomonas* (any one)
15. n
16. e
17. g
18. m
19. j
20. c
21. k
22. h
23. a
24. controlling the pain, cleanliness
25. It alleviates pain, reduces swelling and depth of injury, and promotes subsequent healing.

UNIT 23 / Weight Control Products

1. d
2. f
3. h
4. i
5. j
6. l
7. g
8. e
9. a
10. c
11. Endogenous weight is caused by abnormality within the body, while exogenous weight occurs with excessive food intake.

12. group therapy, behavior modification
13. fat cell theory, infantile obesity theory, adult-onset obesity theory, genetic component theory, environmental influence theory, psychogenic component of obesity theory (any four)
14. phenylpropanolamine, benzocaine, bulk-producing agents, caffeine
15. to overcome the fatigue associated with dieting
16. glucose, low-calorie foods, artificial sweeteners, fad diets, dieting, exercise (any four)
17. motivation and self-discipline, proper exercise, reduced caloric intake, OTC diet aids as needed

UNIT 24 / Health Care Accessories

1. so older stock will be used first, before it goes out of date
2. wound dressings, absorbents, bandages, adhesive tapes, protectives (any three)
3. a product that adds to the convenience or effectiveness of something
4. cushions—to prevent bed sores
   trusses—supports for patients with hernias
   urology and incontinence supplies—to collect urine or to protect a patient who has lost urinary or bowel control
   ostomy supplies—to catch waste from ostomies
   thermometers—to record body temperature
   inhalers and atomizers—to treat respiratory tract conditions
   hypodermic equipment—to give injections
   syringes—to give irrigations (any five)
5. a. absorbent—product with the ability to take in moisture
   b. ostomy—an operation in which parts of the intestines or urinary tract are removed
   c. stoma—an artificial opening created during surgery
   d. truss—a support for a hernia
6. a. electronic thermometer, preferably, but could be fever, rectal, or universal
   b. hospital, adjustable aluminum, offset, quad (any one)
   c. axillary, Canadian or Lofstrand

Introduction to SCANS

The Commission

In February, 1990, the Secretary's Commission on Achieving Necessary Skills (SCANS) was established with representatives from business, education, unions, and government. The Commission issued a report which advised the Secretary of Labor as to:

(a) the skills needed for employment;
(b) proposed acceptable levels in those skills;
(c) effective ways to assess proficiency; and
(d) a strategy to disseminate the finding to the nation's schools, businesses, and homes.

The Commission identified two types of skills required for most jobs—competencies and foundations. *Competencies* are "the skills necessary for success in the work place." *Foundations* are "the skills and qualities that underlie the competencies."

The Department of Labor plans to introduce the SCANS skills into the Job Corps and Job Training Partnership Act (JTPA) programs, beginning with summer programs in 1992. The Alliance, a program of AT&T and its unions (the Communication Workers of America and the International Brotherhood of Electrical Workers) has been asking its vendors to use these materials for the development of SCANS skills and competencies for their programs.

Use of the Report

The report can be used to focus on the SCANS competencies and foundations or to focus on the jobs. Competencies and skills are common to many different jobs. The information is useful to teachers, curriculum developers, and anyone teaching job skills. Those interested in the job will find the SCANS skills rated in descending order of importance for the job. Anyone writing high school curricula will find this report a useful way to relate the teaching of subject matter to the skills required in the workplace. These skills can be taught in a wide range of courses.

The report can be used by a job counselor or training director to help individuals understand the skills required in the workplace and how these skills are used in daily tasks.

Reference: The Secretary's Commission on Achieving Necessary Skills, U.S. Department of Labor. *Skills and Tasks for Jobs: A SCANS Report for America 2000*, Chapter 1, pp. 1-3 through 1-12. U.S. Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328.

SCANS Competencies and Skills

I. Workplace Competencies

Resources
Allocates Time
Allocates Money
Allocates Material and Facility Resources
Allocates Human Resources

Information
Acquires and Evaluates Information
Organizes and Maintains Information
Interprets and Communicates Information
Uses Computers to Process Information

Interpersonal Skills
Participates as a Member of a Team
Teaches Others
Serves Clients/Customers
Exercises Leadership
Negotiates to Arrive at a Decision
Works with Cultural Diversity

Systems
Understands Systems
Monitors and Corrects Performance
Improves and Designs Systems

Technology
Selects Technology
Applies Technology to Task
Maintains and Troubleshoots Technology

II. Foundation Skills

Basic Skills
Reading
Writing
Arithmetic
Mathematics
Listening
Speaking

Thinking Skills
Creative Thinking
Decision Making
Problem Solving
Seeing Things in the Mind's Eye
Knowing How to Learn
Reasoning

Personal Qualities
Responsibility
Self-Esteem
Sociability
Self-Management
Integrity/Honesty

Reference: The Secretary's Commission on Achieving Necessary Skills, U.S. Department of Labor. *Skills and Tasks for Jobs: A SCANS Report for America 2000*, Tables 1-1 and 1-2, pp. 1-4 and 1-5. U.S. Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328.

Codes for SCANS Competencies and Skills

I. SCANS Competencies

C01	Allocates Time
C02	Allocates Money
C03	Allocates Material and Facility Resources
C04	Allocates Human Resources
C05	Acquires and Evaluates Information
C06	Organizes and Maintains Information
C07	Interprets and Communicates Information
C08	Uses Computers to Process Information
C09	Participates as a Member of a Team
C10	Teaches Others
C11	Serves Clients/Customers
C12	Exercises Leadership
C13	Negotiates to Arrive at a Decision
C14	Works with Cultural Diversity
C15	Understands Systems
C16	Monitors and Corrects Performance
C17	Improves and Designs Systems
C18	Selects Technology
C19	Applies Technology to Task
C20	Maintains and Troubleshoots Technology

II. SCANS Foundation Skills

F01	Reading
F02	Writing
F03	Arithmetic
F04	Mathematics
F05	Listening
F06	Speaking
F07	Creative Thinking
F08	Decision Making
F09	Problem Solving
F10	Seeing Things in the Mind's Eye
F11	Knowing How to Learn
F12	Reasoning
F13	Responsibility
F14	Self-esteem
F15	Social
F16	Self-management
F17	Integrity/Honesty

Reference: The Secretary's Commission on Achieving Necessary Skills, U.S. Department of Labor. *Skills and Tasks for Jobs: A SCANS Report for America 2000,* Tables 1-1 and 1-2, pp. 1-4 and 1-5. U.S. Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328.

1 1

Definitions of SCANS Know-How

WORKPLACE COMPETENCIES

Resources

Allocates Time—Selects relevant, goal-related activities, ranks them in order of importance, allocates time to activities, and understands, prepares, and follows schedules.

Allocates Money—Uses or prepares budgets, including making cost and revenue forecasts; keeps detailed records to track budget performance; and makes appropriate adjustments.

Allocates Material and Facility Resources—Acquires, stores, and distributes materials, supplies, parts, equipment, space, or final products in order to make the best use of them.

Allocates Human Resources—Assesses knowledge and skills, distributes work accordingly, evaluates performance, and provides feedback.

Interpersonal Skills

Participates as a Member of a Team—Works cooperatively with others and contributes to group efforts with ideas, suggestions, and effort.

Teaches Others—Helps others learn needed knowledge and skills.

Serves Clients/Customers—Works and communicates with clients and customers to satisfy their expectations.

Exercises Leadership—Communicates thoughts, feelings, and ideas to justify a position, encourage, persuade, convince, or otherwise motivate an individual or groups, including responsibly challenging existing procedures, polices, or authority.

Negotiates to Arrive at a Decision—Works toward an agreement that may involve exchanging specific resources or resolving divergent thoughts.

Works with Cultural Diversity—Works well with men and women and with people from a variety of ethnic, social, or educational backgrounds.

Information

Acquires and Evaluates Information—Identifies a need for data, obtains the data from existing sources or creates them, and evaluates their relevance and accuracy.

Organizes and Maintains Information—Organizes, processes, and maintains written or computerized records and other forms of information in a systematic fashion.

Interprets and Communicates Information—Selects and analyzes information and communicates the results to others using oral, written, graphic, pictorial, or multimedia methods.

Uses Computers to Process Information—Employs computers to acquire, organize, analyze, and communicate information.

Systems

Understands Systems—Knows how social, organizational, and technological systems work and operates effectively within them.

Monitors and Corrects Performance—Distinguishes trends, predicts impacts of actions on system operations, diagnoses deviations in the functioning of a system/organization, and takes necessary action to correct performance.

Improves and Designs Systems—Makes suggestions to modify existing systems in order to improve the quality of products or services and develops new or alternative systems.

Technology

Selects Technology—Judges which sets of procedures, tools, or machines, including computers and their programs, will produce the desired results.

Applies Technology to Task—Understands the overall intents and the proper procedures for setting up and operating machines, including computers and their programming systems.

Maintains and Troubleshoots Technology—Prevents, identifies, or solves problems in machines, computers, and other technologies.

FOUNDATION SKILLS

Basic Skills

Reading—Locates, understands, and interprets written information in prose and documents—including manuals, graphs, and schedules—to perform tasks; learns from text by determining the main idea or essential message; identifies relevant details, facts, and specifications; infers or locates the meaning of unknown or technical vocabulary; and judges the accuracy, appropriateness, style, and plausibility or reports, proposals, or theories of other writers.

Writing—Communicates thoughts, ideas, information, and messages in writing; records information completely and accurately; composes and creates documents such as letters, directions, manuals, reports, graphs, and flow charts with the language, style, organization, and format appropriate to the subject matter, purpose, and audience; includes, where appropriate, supporting documentation, and attends to level of detail; and check, edits, and revises for correct information, appropriate emphasis, form, grammar, spelling, and punctuation.

Arithmetic—Performs basic computations; uses basic numerical concepts such as whole numbers and percentages in practical situations; makes reasonable estimates of arithmetic results without a calculator; and uses tables, graphs, diagrams, and charts to obtain or convey quantitative information.

Mathematics—Approaches practical problems by choosing appropriately from a variety of mathematical techniques; uses quantitative data to construct logical explanations for real world situations; expresses mathematical ideas and concepts orally and in writing; and understands the role of chance in the occurrence and prediction of events.

Listening—Receives, attends to, interprets, and responds to verbal messages and other cues such as body language in ways that are appropriate to the purpose—for example, to comprehend, learn, critically evaluate, appreciate, or support the speaker.

Speaking—Organizes ideas and communicates oral messages appropriate to listeners and situations; participates in conversation, discussion, and group presentations; selects an appropriate medium for conveying a message; uses verbal language and other cues such as body language in a way appropriate in style, tone, and level of complexity to the audience and the occasion; speaks clearly and communicates a message; understands and responds to listener feedback; and asks questions when needed.

Thinking Skills

Creative Thinking—Generates new ideas by making nonlinear or unusual connections, changing or reshaping goals, and imagining new possibilities; and uses imagination freely, combining ideas or information in new ways, making connections between seemingly unrelated ideas, and reshaping goals in ways that reveal new possibilities.

Decision Making—Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternatives.

Problem Solving—Recognizes that a problem exists (i.e., that there is a discrepancy between what is and what should be); identifies possible reasons for the discrepancy, and devises and implements a plan of action to resolve it; and evaluates and monitors progress, revising the plan as indicated by findings.

Seeing Things in the Mind's Eye (Mental Visualization)—Sees things in the mind's eye by organizing and processing symbols, pictures, graphs, objects, and other information—for example, the flow of work activities from narrative descriptions or the taste of food from reading a recipe.

Knowing How to Learn—Recognizes and can use learning techniques to apply and adapt existing and new knowledge and skills in both familiar and changing situations; and is aware of learning tools such as personal learning styles (visual, aural, etc.), formal learning strategies (notetaking or clustering items that share some characteristics), and informal learning strategies (awareness of unidentified false assumptions that may lead to faulty conclusions).

Reasoning—Discovers a rule or principle underlying the relationship between two or more objects and applies it in solving a problem—for example, uses logic to draw conclusions from available information or applies rules and principles to a new situation.

Personal Qualities

Responsibility—Exerts a high level of effort and perseverance toward goal attainment; works hard to become excellent at doing tasks by setting high standards, paying attention to details, working well even when assigned an unpleasant task, and displaying a high level of concentration; and displays high standards of attendance, punctuality, enthusiasm, vitality, and optimism in approaching and completing tasks.

Self-Esteem—Believes in own self-worth and maintains a positive view of self, demonstrates knowledge of own skills and abilities, is aware of one's own impression on others, and knows own emotional capacity and needs and how to address them.

Sociability—Demonstrates understanding, friendliness, adaptability, empathy, and politeness in new and ongoing group settings; asserts self in familiar and unfamiliar social situations; relates well to others; responds appropriately as the situation requires; and takes an interest in what others say and do.

Self-Management—Accurately assesses own knowledge, skills, and abilities; sets well-defined and realistic personal goals; monitors progress toward goal attainment and motivates self through goal achievement; and exhibits self-control and responds to feedback unemotionally and nondefensively.

Integrity/Honesty—Recognizes when being faced with making a decision or exhibiting behavior that may break with commonly held personal or societal values; understands the effects of violating these beliefs and codes on an organization, oneself, and others; and chooses an ethical course of action.

Reference: The Secretary's Commission on Achieving Necessary Skills, U.S. Department of Labor. *Learning for a Living A Blueprint for High Performance, A SCANS Report for America 2000,* Appendix B, pp. 81-88. U.S. Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328.

Competency Chart
Pharmacy Assistant

Directions: Evaluate the trainee, using the rating scale below. Place a check in the appropriate square to indicate degree of skill.

Rating Scale:
4 Skilled—can work independently with no supervision
3 Moderately skilled—can perform job completely with limited supervision
2 Limited skill—requires instruction and close supervision
1 No exposure—no experience or knowledge in this area

UNIT 1: Careers in Pharmacy	4	3	2	1
1. Define pharmacy, pharmacist, and pharmacy technician.				
2. Discuss the historical development of pharmacy.				
3. List the educational and licensing requirements for a pharmacist.				
4. Describe and evaluate the opportunities for a career in pharmacy.				
5. Point out how the role of the pharmacist has changed.				

UNIT 2: Ethics and Customer-Patient Relations	4	3	2	1
1. Discuss the role of ethics in the pharmacy profession.				
2. Summarize the American Pharmaceutical Association Code of Ethics.				
3. Identify guidelines for dealing with customers and patients in the pharmacy.				
4. Discuss the pharmacist's role in the health care delivery system.				
5. List the skills that will help you deal with complaints from customers and patients.				

UNIT 3: Drug Legislation	4	3	2	1
1. Define common legal terms used in pharmacy.				
2. List three levels of regulations, and determine which prevails if there is conflict.				
3. List and describe the two federal agencies involved with pharmacy and drug regulation and enforcement.				
4. List and describe two state agencies involved with pharmacy and drug regulation and enforcement.				
5. List the categories of scheduled drugs.				

UNIT 4: Safety	4	3	2	1
1. Give the purpose of OSHA.				
2. Discuss hazards in the pharmacy.				
3. Describe the importance of cleanliness in the pharmacy.				
4. Tell how to care for specialized pharmaceutical equipment.				
5. Point out special problems connected with a hospital pharmacy.				
6. List five general fire safety rules for the pharmacy.				
7. List general rules about what to do in the event of a robbery.				

4 3 2 1

UNIT 5: Dispensing in the Pharmacy

1. Give the definition of a prescription.
2. Name and describe the parts of a prescription.
3. Identify Latin abbreviations used in prescriptions.
4. List the five "rights" of medication dispensing.
5. Describe the procedures for handling new and refill prescriptions.

UNIT 6: Materials Management

1. Discuss the questions a pharmacy worker should keep in mind when checking in a new shipment.
2. Describe methods of storage for drugs and pharmaceutical supplies in the pharmacy work area and the bulk storeroom.
3. List the temperature ranges used in temperature control.
4. Give the standards for the different drug containers.
5. Discuss what is meant by repackaging, prepackaging, and unit-dose packaging.
6. Discuss the three drug distribution systems employed in hospitals.

UNIT 7: Metrology

1. Discuss the systems of weights and measures used in pharmacy.
2. Identify the symbols and abbreviations of the weights and measures used in pharmacy.
3. Convert numbers from Arabic to Roman and Roman to Arabic.
4. Perform simple calculations that will be required of a worker in the pharmacy where you are working.

UNIT 8: Managing a Pharmacy

1. Define *management.*
2. Name the functions of management.
3. Discuss the basic functions of an organization.
4. Describe the functions of computers in pharmacy.
5. List components needed for data processing.
6. Determine the data included in a patient profile.

UNIT 9: Names, Sources, and Dosages of Drugs

1. Differentiate between the chemical, generic, and trade names of drugs.
2. Discuss the sources of drugs.
3. Describe the dosage forms used in dispensing drugs.
4. Discuss the factors that must be taken into account when determining the dose of a drug for a patient.
5. Differentiate between a drug's action and its effects.
6. Describe the basic mechanism of drug action.
7. Discuss the use of diagnostic aids.
8. Describe, in general terms, interactions between drugs.

UNIT 10: Routes of Administration

1. Discuss five considerations used to determine the best route of administration for a drug.
2. Identify and define the routes of drug administration.
3. List advantages and disadvantages of the routes of administration.
4. Give examples of medications administered by each route of administration.

UNIT 11: Cardiovascular Drugs

	4	3	2	1
1. List the parts of the cardiovascular system.	☐	☐	☐	☐
2. Discuss the ways by which cardiac drugs can affect the heart.	☐	☐	☐	☐
3. Describe the role diuretics play in treating hypertension and other cardiovascular diseases.	☐	☐	☐	☐
4. Discuss the other types of drugs used to treat hypertension.	☐	☐	☐	☐
5. Give examples of drugs used in shock and hypotension.	☐	☐	☐	☐
6. Name the agents used in vascular disorders other than hypertension.	☐	☐	☐	☐
7. Differentiate between coagulants and anticoagulants.	☐	☐	☐	☐

UNIT 12: Gastrointestinal Drugs

	4	3	2	1
1. List the parts of the gastrointestinal system.	☐	☐	☐	☐
2. Describe the role that digestants play in the treatment of gastrointestinal disorders.	☐	☐	☐	☐
3. Discuss the role of anticholinergics, antispasmodics, and histamine-2 receptor blockers in treating gastrointestinal disorders, particularly peptic ulcers.	☐	☐	☐	☐
4. Compare emetics and antiemetics for treatment of gastrointestinal disorders.	☐	☐	☐	☐
5. Give examples of anthelmintics used in the treatment of gastrointestinal disorders.	☐	☐	☐	☐

UNIT 13: Respiratory Drugs

	4	3	2	1
1. List the parts of the respiratory system.	☐	☐	☐	☐
2. Describe the functions of the parts of the respiratory system.	☐	☐	☐	☐
3. Give examples of types of drugs that are used as bronchodilators.	☐	☐	☐	☐
4. Discuss the preventive management of asthma with drugs.	☐	☐	☐	☐

UNIT 14: Nervous System Drugs

	4	3	2	1
1. Name the parts of the central nervous system.	☐	☐	☐	☐
2. Discuss the functions of each of the parts of the central nervous system.	☐	☐	☐	☐
3. Identify the major classes of drugs that act on the central nervous system.	☐	☐	☐	☐
4. List examples of drugs within the classes of agents that act on the central nervous system.	☐	☐	☐	☐

UNIT 15: Hormones

	4	3	2	1
1. Discuss the differences between endocrine and exocrine glands.	☐	☐	☐	☐
2. List the major endocrine glands of the body.	☐	☐	☐	☐
3. List representative hormones from each of the major endocrine glands.	☐	☐	☐	☐
4. Briefly describe the functions of the major hormones in the body.	☐	☐	☐	☐

UNIT 16: Drugs for Infectious Diseases and Cancer

	4	3	2	1
1. Identify the major classes of anti-infectives.	☐	☐	☐	☐
2. List examples of drugs within the major classes of anti-infectives.	☐	☐	☐	☐
3. Describe the problem of resistance to anti-infectives.	☐	☐	☐	☐
4. Differentiate between narrow- and broad-spectrum antibiotics.	☐	☐	☐	☐
5. Discuss the reason for multiple-drug therapy in the treatment of cancer.	☐	☐	☐	☐
6. List the general categories of antineoplastic agents, with one specific example of each.	☐	☐	☐	☐

4 3 2 1

UNIT 17: Nonprescription Medications in the Pharmacy

1. Describe the role of self-medication with OTC products in the health care delivery system. ☐ ☐ ☐ ☐
2. Discuss how to know when OTC medication is appropriate. ☐ ☐ ☐ ☐
3. List and discuss federal regulations for nonprescription drugs. ☐ ☐ ☐ ☐
4. Evaluate the advertising of OTC products. ☐ ☐ ☐ ☐

UNIT 18: Nonprescription Gastrointestinal Products

1. Identify the main objectives of treatment with antacids. ☐ ☐ ☐ ☐
2. List the main ingredients in selected nonprescription antacids. ☐ ☐ ☐ ☐
3. Tell when and how to obtain the best results from antacids. ☐ ☐ ☐ ☐
4. Name the various causes of diarrhea. ☐ ☐ ☐ ☐
5. List the ingredients in the most common over-the-counter products for diarrhea. ☐ ☐ ☐ ☐
6. Describe the common uses for laxatives. ☐ ☐ ☐ ☐
7. Differentiate between different types of laxatives. ☐ ☐ ☐ ☐
8. Identify ingredients in OTC laxative products. ☐ ☐ ☐ ☐

UNIT 19: Analgesics

1. Define *analgesic.* ☐ ☐ ☐ ☐
2. Discuss the function of pain in the body. ☐ ☐ ☐ ☐
3. Identify the different types of over-the-counter analgesics and their components. ☐ ☐ ☐ ☐
4. Discuss analgesic dosage forms. ☐ ☐ ☐ ☐

UNIT 20: Allergy, Cough, and Cold Products

1. Tell what causes the common cold. ☐ ☐ ☐ ☐
2. List the symptoms of the common cold and many common allergies. ☐ ☐ ☐ ☐
3. Discuss the treatments for the symptoms of cold and allergies. ☐ ☐ ☐ ☐
4. Discuss ingredients in over-the-counter products for colds and allergies. ☐ ☐ ☐ ☐

UNIT 21: Nutritional Supplements, Vitamins, and Minerals

1. Discuss the role of vitamins in nutrition. ☐ ☐ ☐ ☐
2. Name the fat-soluble vitamins and a function of each one. ☐ ☐ ☐ ☐
3. Name the water-soluble vitamins and a function of each one. ☐ ☐ ☐ ☐
4. Discuss the role of minerals in nutrition. ☐ ☐ ☐ ☐

UNIT 22: Products for the Skin

1. Describe the symptoms of poison ivy and poison oak dermatitis. ☐ ☐ ☐ ☐
2. Identify types of treatment for poison ivy and poison oak dermatitis. ☐ ☐ ☐ ☐
3. Discuss the major types of medications used in products for the treatment of poison oak and poison ivy dermatitis. ☐ ☐ ☐ ☐
4. Identify the three severity levels of burns. ☐ ☐ ☐ ☐
5. List techniques for the treatment of both major and minor burns. ☐ ☐ ☐ ☐
6. Discuss photosensitivity. ☐ ☐ ☐ ☐
7. Name the most common agents found in commercial preparations for burns and sunburn. ☐ ☐ ☐ ☐

UNIT 23: Weight Control Products

	4	3	2	1
1. Discuss the theories concerning the etiology of obesity.				
2. Discuss the effectiveness of over-the-counter products for controlling weight.				
3. List ingredients in over-the-counter products used for weight control.				
4. Name methods other than the use of diet aids for weight control.				

UNIT 24: Health Care Accessories

1. Name types of surgical supplies and discuss their use.				
2. List health or prescription accessories and discuss their use.				

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WORKING IN PHARMACIES

BEST COPY AVAILABLE

Working in Pharmacies

Student's Manual

By

Carl W. Driever

and

Larry McClaugherty

Revised by

Helena J. Fair

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Foreword

Working in Pharmacies is designed for use by students investigating activities within the pharmacy or considering further training for a career in pharmacy. The material is designed to relate training experience to information studies in the classroom. Students using this material can work at their own pace, which enables them to concentrate on areas that best fit their specific needs. The material is competency-based, with educational outcomes stated for each unit. Information is relevant and current. *Working in Pharmacies* is made up of three separate publications.

- The **Student's Manual** contains learning objectives, terms and definitions, and information relating to current techniques and practices. Topics addressed include ethics and customer relations, drug legislation, safety, and material management. Careers and responsibilities in pharmacy are described. Dispensing and metrology are discussed. Later units are arranged into two major groups. The first group of units deals with prescription drugs as they pertain to various body systems. The second group presents information on nonprescription products for specific conditions.

- The **Student Learning Activities** are individualized and designed to encourage the student to carefully read and study information presented. Questions in activities are designed for practice in both basic performance and thinking skills. Each unit has a section for those students desiring more advanced study. The number completed may be negotiated. All activities are related to the SCANS competencies and skills. Instructors are encouraged to provide one set of activities for each student to facilitate learning.

- The **Instructor's Guide** provides a list of suggested educational outcomes correlated to the units of instruction. A basic test is provided for each unit. Instructors are encouraged to enlarge and/or individualize these. Answers to learning activities and tests are included. A competency chart is included. An introduction to the SCANS competencies and skills is presented.

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The authors of the 1982 publication were Carl W. Driever, Associate Professor of Clinical Pharmacy at the University of Houston, and Larry McClaugherty, Lecturer in the Clinical Pharmacy and Administration Department of the College of Pharmacy at the University of Houston. The current publication bears the marks of Dr. Driever's extensive teaching and research and McClaugherty's experience as a retail pharmacist.

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- Chris Paap, Pharm.D., Assistant Professor, The University of Texas at Austin, College of Pharmacy; pharmacist at Brackenridge Hospital, Austin, Texas
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1

Careers in Pharmacy

Objectives: After completing this unit, you will be able to—

1. *define pharmacy, pharmacist, and pharmacy technician;*
2. *discuss the historical development of pharmacy;*
3. *list the educational and licensing requirements for a pharmacist;*
4. *describe and evaluate the opportunities for a career in pharmacy; and*
5. *point out how the role of the pharmacist has changed.*

TERMS AND DEFINITIONS

apothecary—name given in former times to the physician-pharmacist; also refers to the small pharmacy that offers prescription service but little other merchandise

clinical pharmacy—working with the specific needs of a patient as part of a team of physicians, nurses, pharmacists, and other health professionals

OBRA 90—Omnibus Budget Reconciliation Act of 1990; a law that governs patient counseling and Drug Use Review (DUR) in pharmacy

pharmaceutical chemistry—the application of organic and inorganic chemistry to medications

pharmaceutics—the science of dispensing medicines

pharmacognosy—the study of drugs derived from natural sources

pharmacology—the study of the actions and uses of drugs

pharmacist—a person who is responsible for storing, preparing, and dispensing drugs and medicines prescribed by other health professionals, and for advising people in the use of medicine and drugs

pharmacy—the art and science of dispensing, from natural and synthetic sources, medications for use in the treatment and prevention of disease

pharmacy administration—the principles and practices of business and law as they apply to pharmacy practice

pharmacy technician—a person who stores, prepares, and dispenses drugs and medicines under the direction of a pharmacist

pharmakon—a Greek word meaning medicine or drug

reciprocity—the ability to practice pharmacy in a state other than the state in which the pharmacist was originally licensed

Pharmacy is the art and science of dispensing, from natural and synthetic sources, medications for use in the treatment and prevention of disease. The word pharmacy is derived from the Greek word ***pharmakon***, which means medicine or drug. The ***pharmacist*** (fig. 1) is responsible for storing, preparing, and dispensing medicines and drugs prescribed by doctors, dentists, and veterinarians, and for advising people in the use of medicines and drugs that can be obtained with or without prescriptions. The ***pharmacy technician*** works under the direction of a pharmacist to store, prepare, and dispense drugs and medicines. All who work in the pharmacy share the responsibility of being professional and knowledgeable in the properties and uses of medicines and drugs—and in their dealings with the public.

Fig. 1. A pharmacist at work

A BRIEF HISTORY

The practice of pharmacy first appears in records from the pre-Christian civilizations of Babylonia and Egypt. Small clay tablets and long scrolls that survive from those times show that medications were prepared in some of the same forms in which they are dispensed today: gargles, suppositories, poultices, and ointments.

The ancient medical practitioners were their own pharmacists. They distilled, mixed, and dispensed medicines according to tradition and their own experience and experimentation. The development of pharmacy as a separate field did not occur until the late Middle Ages.

During the Middle Ages in Europe, monasteries became the centers of intellectual life. Pharmacy and medicine, along with the other arts and sciences, continued their evolution behind medieval monastery walls. Then, as the Middle Ages waned, the chemists and physicians and apothecaries gradually moved from the monasteries into the growing urban centers. As life in Europe became more secular and commercial, the medical arts began developing into separate fields with independent standards and responsibilities.

Around the time of the American Revolution, anyone who wanted to could set up shop as a physician-pharmacist or ***apothecary.*** Some practitioners had been formally trained in England or Europe, and some gained their knowledge through apprenticeship. Many, however, had little knowledge or experience. The need for a higher level of competence and professional standards brought about the creation of the Philadelphia College of Pharmacy in 1821.

During the nineteenth century, the modern profession of pharmacy began to emerge from the work of the "chymists" and "druggists" of the times, along with the modernization and standardization of the practice of medicine. These developments in Europe were carried to America. English tradition, in particular, had a strong influence on the shape of the pharmacy profession in the United States.

DEVELOPMENT OF THE PROFESSIONAL CURRICULUM

From the apprenticeship system, the education of pharmacists had evolved to a two-year course of formal study by the early 1900s. A four-year curriculum was adopted in 1932, and the present five-year curriculum was adopted as a minimum course of study in 1960. Currently, a student receives a Bachelor of Science degree in pharmacy after completing five years of study.

There is controversy today over changes in the pharmacy curriculum. Some members of the profession support requiring a six-year curriculum, with the student receiving a Doctor of Pharmacy degree upon successful completion. They say that growth in the field of knowledge of pharmacy justifies extending the curriculum. In fact, most colleges of pharmacy are moving toward this degree program.

Most colleges of pharmacy have a two-year prepharmacy program covering the basic sciences and humanities. Students take courses in biology, chemistry, physics, organic chemistry, economics, history, English, and other requirements for a Bachelor of Science degree. Then, after two years, students are eligible for the three- or four-year professional program.

The professional courses vary in scope and content in different colleges of pharmacy. Many colleges are making serious attempts at this time to gear their curricula more closely to the practical demands of the profession, rather than the theoretical. The common goal of today's colleges of pharmacy is to prepare individuals to function as members of the health care team. All pharmacy professional programs include offerings in:

- *pharmacology*—the study of the actions and uses of drugs;
- *pharmacognosy*—the study of drugs derived from natural sources;
- *pharmaceutical chemistry*—the application of organic and inorganic chemistry to medications;
- *pharmaceutics*—the science of dispensing medicines;
- *clinical pharmacy*—working with the specific needs of a patient as part of a team of physicians, nurses, pharmacists, and other health care workers; and
- *pharmacy administration*—the principles and practices of business and law as they apply to pharmacy practice.

For information on specific pharmacy programs in Texas, write to one of the accredited colleges listed in table 1.

QUALIFICATIONS FOR LICENSING

After completing the professional program, the pharmacy student must pass a state examination to become a licensed pharmacist. The licensing and practice of pharmacy within each state are regulated by state laws. To practice pharmacy in any state, a pharmacist must be a registered pharmacist (R.Ph.) in that state. Pharmacists are regulated by the board of pharmacy within a particular state. The State Board of Pharmacy in Texas consists of nine people—seven pharmacists and two consumers.

To qualify for a license to practice pharmacy in Texas, an applicant must submit a license fee and a completed application on a form prescribed by the board. The application requires that the applicant be at least 18 years old and of good moral character. In addition, the applicant must have:

1. completed at least a 1,000-hour internship or other program approved by the board, or demonstrated, to the board's satisfaction, experience in the practice of pharmacy that meets or exceeds the minimum internship requirements of the board;
2. graduated and received a professional degree from an accredited college of pharmacy; and
3. passed the state board examination.

RECIPROCITY LICENSING IN TEXAS

A pharmacist who is licensed in one state may practice in another state by fulfilling the reciprocity requirements of the other state. In most cases this only requires passing its state pharmacy law examination and paying a fee. California and Hawaii are nonreciprocating states. These states require a person to fulfill residence and internship requirements and to pass the state's complete licensure examination.

To qualify for a license to practice pharmacy by reciprocity in Texas, an applicant for licensing must:

1. submit to the board the required reciprocity fee and the completed official application, given under oath;
2. demonstrate good moral character;
3. have graduated and received a professional degree from an accredited college of pharmacy;
4. have possessed at the time of initial licensing other qualifications necessary to have been eligible for licensing at that time in this state;
5. have presented to the board proof of initial licensing by examination and proof that the license and other license or licenses granted to the applicant by any other state have not been suspended, revoked, canceled, or otherwise restricted for any reason; and
6. have passed the Texas drug and pharmacy jurisprudence examination.

TABLE 1
Colleges of Pharmacy in Texas

The University of Houston
College of Pharmacy
4800 Calhoun Road
Houston, TX 77004

The University of Texas at Austin
College of Pharmacy
201 W. 21st Street
Austin, TX 78712

Texas Southern University
College of Pharmacy
3201 Wheeler Avenue
Houston, TX 77004

OPPORTUNITIES IN PHARMACY

About 90 percent of all pharmacists enter community or institutional pharmacy upon graduation and licensure. Other career opportunities in pharmacy include:

- drug wholesaling;
- research and manufacturing;
- pharmaceutical marketing and advertising;
- professional writing;
- teaching; and
- government service (Veterans Administration, Public Health Service, FDA, etc.).

THE COMMUNITY PHARMACY

When they think of a pharmacist, most people think first of the pharmacist in their local pharmacy. About 70 percent of all pharmacists are community pharmacists. Until the middle of the century, most pharmacists worked in their own, individually owned pharmacies. Today, one of the most rapidly growing areas of practice is in chain drugstores and other chain retail outlets that house pharmacies.

Establishing or owning your own pharmacy appeals to many Americans because of the American ideal of being self-employed. However, it also demands the most capital investment and exposes the pharmacist to the greatest business risk. Until it is well established, an individually owned pharmacy will also demand a great deal of work and business sense. A person with the resources to run a private pharmacy business can derive great satisfaction from it.

A person working in a chain drugstore can also derive great satisfaction from the opportunities in pharmacy. Workers in both individually owned and corporate, chain pharmacies may be motivated by the same factors: to serve the public, to have a responsible position in the community, to play a part in improving public health, to work with and earn the respect of professionals and others in pharmacy work, and to make a living in a challenging, ever-changing field.

One of the requirements for success in retailing is a liking for people. You must enjoy meeting people, be able to talk with them, and take an interest in them. Most important, a pharmacist practicing in any community pharmacy is a trained professional, licensed by law, and sworn to protect the health, safety, and welfare of the public. Anyone working in a pharmacy shares the opportunities, and the obligations, of the profession.

A new career opportunity in pharmacy today is related to the growth of chain drugstores.

Corporate chains differ from individually owned stores by having a central headquarters and management. Your training and attitude toward retail practice may lead you into corporate management. As a member of the headquarters staff, the pharmacist can provide professional influence at the corporate, rather than the individual store, level. Pharmaceutical buying, merchandising, pharmacy operations, personnel, recruitment, and professional relations are just a few of the types of positions available.

THE HOSPITAL PHARMACY

The second largest sector of employment in pharmacy includes hospital and clinical pharmacists. In most schools of pharmacy, students are exposed to the concepts and duties of institutional practice through undergraduate instruction. A major difference between community and institutional pharmacy is the formalized and coordinated structure of the hospital environment. The structure of the hospital health care delivery system lends itself to specialization. Hospital pharmacy, initially a specialty of pharmacy, is now a parent to numerous subspecialties.

Pharmacists may be involved in the daily duties of dispensing to hospital patients and maintaining records. However, some of these duties may be assigned to pharmacy technicians.

The size and character of the hospital may also involve pharmacists in other specialized projects. Special areas of hospital pharmacy include pediatric drug therapy; manufacturing of sterile solutions and other dosage forms; drug information services; maintenance of patient medication profiles; intravenous (IV) additive services; stocking of hospital emergency carts; operation of poison control centers; radiopharmaceutical dispensing and research; determination of drug usage and standards; in-service education of nurses, physicians, and technicians; implementation of electronic data processing systems; service to nursing homes and intensive care units; and pharmacy administration.

Regardless of the size of the hospital, the first obligation of the hospital pharmacist is that of an expert on drugs. The in-service education of nurses, physicians, and technicians is often required of the pharmacist. These health professionals look to the pharmacist to instruct them in various areas of drug use, such as therapy, interactions, contraindications, and dosages. Communication about drugs and their use is a professional necessity, and it is extremely important that the various members of the health care team work together on a daily basis. Conversely, the hospital pharmacist learns more about diagnosis and disease by accompanying the physician on rounds to the patient's bedside.

As an administrator, the hospital pharmacist helps establish policies and procedures in the pharmacy, prepares reports and budgets, maintains purchasing and inventory records, and evaluates innovative drug distribution and communication systems.

THE CHANGING ROLE OF THE PHARMACIST

The role of the pharmacist is changing from one who prepares, stores, and dispenses drugs and medications prescribed by other health professionals to that of consultant to the patient. The Omnibus Budget Reconciliation Act of 1990 (OBRA 90) requires pharmacists to provide counseling for patients and to perform drug use reviews (DUR) to detect and prevent problems with drug therapy. Under the provisions of this act, the pharmacist should be involved in:

- screening of the prescription before it is dispensed to resolve potential problems and counseling of patients about the prescription;
- ongoing periodic examination of pharmacy records to identify areas or patterns of abuse, overuse, or fraud; and
- educational programs for customers, patients, and their caregivers.

All phases of OBRA 90 compliance must be documented.

Pharmacists have become specialists on how drugs are made, the effects on the body, and their interactions with other medications. In the near future, the pharmacist will become a personal health care consultant to advise the community on issues related to drugs and health and will work in cooperation with physicians to ensure quality health care and fiscal management. Pharmacists will assume clinical roles as pharmacy technicians take responsibility for tasks now carried out by pharmacists.

The role of the pharmacy technician soon will be that of assistant to the pharmacist. Technical responsibilities will consist of labeling, storing, distributing, and controlling stock. The assistant will work with patient records, billing information, gathering information for the pharmacist, and distribution of printed information to the patient. Many of these responsibilities will be facilitated by computer. At present there is no licensure for pharmacy technicians. Chapters of the Association of Pharmacy Technicians (APT) exist in some states and can supply career information (see table 2).

SUMMARY

A pharmacist is responsible for advising people about medications and for storing, preparing, and dispensing drugs and medications with the assistance of pharmacy technicians. A pharmacist's professional education consists of five years of study at a recognized college and passing a state examination. Most will work in a community or institutional pharmacy, but other opportunities exist in research, sales, manufacturing, teaching, and government service. The role of the pharmacist is changing to that of a consultant who advises on issues related to health and use of medications.

TABLE 2
Professional Associations

American Pharmaceutical Association
2215 Constitution Avenue NW
Washington, DC 20037

Association of Pharmacy Technicians
P.O. Box 829
Catlin, IL 61817

2

Ethics and Customer-Patient Relations

Objectives: After completing this unit, you will be able to—

1. *discuss the role of ethics in the pharmacy profession;*
2. *summarize the American Pharmaceutical Association Code of Ethics;*
3. *identify guidelines for dealing with customers and patients in the pharmacy;*
4. *discuss the pharmacist's role in the health care delivery system; and*
5. *list the skills that will help you deal with complaints from customers and patients.*

TERMS AND DEFINITIONS

American Pharmaceutical Association (APhA)—national organization of pharmacists; developed a code of ethics

ethics—a set of moral principles or values

law—correct behavior required by a government

Pharmacists are bound together by a common bond—concern for the health and well-being of the patient. Ethics and law in pharmacy, as in all professions, reflect that common bond by making practitioners aware of their responsibility to the public. The ethics, laws, and regulations of the profession extend to all those who work in pharmacy. *Laws* are correct behavior required by a government. The *ethics* of a profession are a set of moral principles or values. These are developed within the profession by its members.

In fields in which the practitioner has special knowledge usually unknown by the public, it is especially difficult for the patient or client to assess the quality of service. There is also real potential for harm if the practitioner fails to uphold a professional code of behavior. A relationship of trust can exist between the pharmacist and the client only if the client has confidence in the pharmacist's adherence to a code of ethics.

THE PHARMACIST'S CODE OF ETHICS

The foundation of all ethical behavior is this basic concept: do good and avoid evil. The ethics of pharmacy attempt to relate this basic concept to the practice of pharmacy.

The first code of ethics for pharmacists in the United States was adopted in 1848 by the Philadelphia College of Pharmacy. When the American Pharmaceutical Association (APhA) was founded in 1852, it adopted a code of ethics modeled after that of the Philadelphia College of Pharmacy. The APhA code (shown in fig. 1) is generally recognized as the foremost code of conduct for American pharmacists.

Professional ethics are concerned not only with the moral conduct of the practitioner but also with the function the professional performs and the quality of this performance. The pharmacist's code of ethics summarizes the role of the pharmacist in the health care delivery system and also the role the pharmacist must assume in the community.

WORKING IN THE COMMUNITY PHARMACY

In the pharmacy you will be dealing regularly with customers, patients, and other pharmacy workers and professionals. Skill in working with people is an important requirement of your job.

Code of Ethics

American Pharmaceutical Association

Preamble

These principles of professional conduct are established to guide pharmacists in relationships with patients, fellow practitioners, other health professionals, and the public.

A Pharmacist should hold the health and safety of patients to be of first consideration and should render to each patient the full measure of professional ability as an essential health practitioner.

A Pharmacist should never knowingly condone the dispensing, promoting, or distributing of drugs or medical devices, or assist therein, that are not of good quality, that do not meet standards required by law, or that lack therapeutic value for the patient.

A Pharmacist should always strive to perfect and enlarge professional knowledge. A pharmacist should utilize and make available this knowledge as may be required in accordance with the best professional judgment.

A Pharmacist has the duty to observe the law, to uphold the dignity and honor of the profession, and to accept its ethical principles. A pharmacist should not engage in any activity that will bring discredit to the profession and should expose, without fear or favor, illegal or unethical conduct in the profession.

A Pharmacist should seek at all times only fair and reasonable remuneration for professional services. A pharmacist should never agree to, or participate in, transactions with practitioners of other health professions or any other person under which fees are divided or that may cause financial or other exploitation in connection with the rendering of professional services.

A Pharmacist should respect the confidential and personal nature of professional records; except where the best interest of the patient requires or the law demands, a pharmacist should not disclose such information to anyone without proper patient authorization.

A Pharmacist should not agree to practice under terms or conditions that interfere with or impair the proper exercise of his professional judgment and skill, that cause a deterioration of the quality of professional services, or that require consent to unethical conduct.

A Pharmacist should strive to provide information to patients regarding professional services truthfully, accurately, and fully and should avoid misleading patients regarding the nature, cost, or value of these professional services.

A Pharmacist should associate with organizations having for their objective the betterment of the profession of pharmacy and should contribute time and funds to carry on the work of these organizations.

Fig. 1. Code of ethics for pharmacists

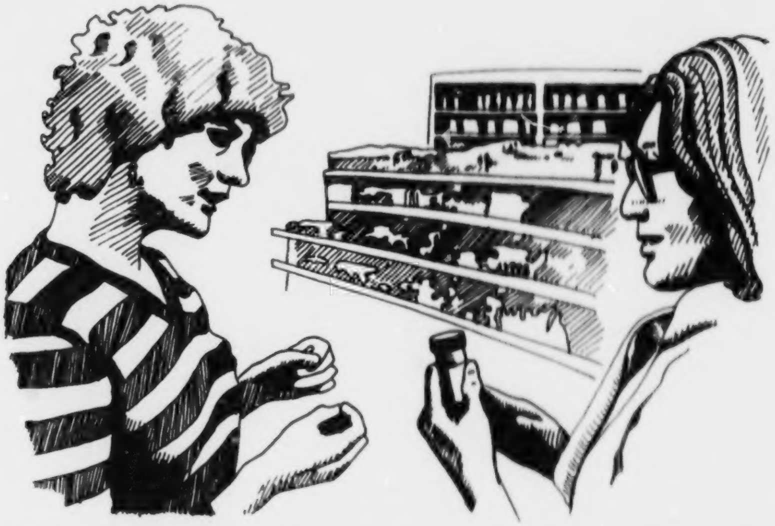


Fig. 2. The pharmacist should be at the drug customer's disposal for consultation.

A retail or community pharmacy is different from other businesses in that it is also a part of the health care delivery system. In addition to maintaining a friendly, efficient business atmosphere, the people who work in pharmacies must learn to work with customers whose major concern is their own health or illness.

Consumers, whether they are well or ill, will respond favorably and bring their business back to a pharmacy where they are treated with courtesy and respect. They will not come back if they have been ignored or oversold, received rude or insincere treatment, or paid high prices for unsatisfactory products. Everyone who works in the pharmacy can contribute to creating a friendly, professional atmosphere. Remember to use the following simple guidelines.

Use the personal touch. Treat customers as you would wish to be treated. You will see some people more than once over time. Let them know that you remember them. Remember their names if possible.

Maintain a professional appearance. A well-groomed, appropriately dressed person commands the customer's respect and confidence. You will probably wear a smock or lab coat over clothes that should be neat, clean, and conservative in style. Avoid sports clothes and tennis shoes, sandals, or other unconventional footwear. Always wear your name badge at work. Remember that even in your appearance you represent both the pharmacy where you work and the profession of pharmacy.

Be prompt and courteous. A waiting customer should be acknowledged even if all employees are busy. Most customers will wait patiently for their turn if they know that you will help them as soon as you can.

THE PHARMACIST'S CONTRIBUTION

The pharmacist's job of dispensing drugs will usually be dissociated as much as possible from the commercial activities in the pharmacy. Like all workers in the pharmacy, the pharmacist, too, has basic guidelines to follow in his or her relations with customers.

Be responsible to each individual patient. Just as the relationship between doctor and patient is "personal," so should the relationship between the pharmacy and the patient be personal. People who come to pharmacists with prescriptions or to buy nonprescription drugs are concerned about their state of health. The pharmacist needs to recognize their individuality and their need for thoughtful, concerned help.

Share knowledge with the patient or customer. The pharmacist must be at the drug customer's disposal for consultation, as shown in figure 2. The prescription patient may need further explanation of the proper administration of the medication. The pharmacist must also discuss side effects and either proper storage or the need to use up all the prescription.

About one-third of the total drug market today consists of nonprescription drugs. As a drug specialist, the pharmacist has the opportunity to consult often with the self-medicating public. This is a valuable public health service. With the many products to choose among, it is important for people to know that the pharmacist is available to help them evaluate those products. The pharmacist should communicate with people in terms they can understand.

The pharmacist also needs to remember that certain aspects of a patient's medication are best left to the physician to discuss with the patient. This might be true when the medication is a placebo, when the physician is using an investigational drug in a clinical study, or when the patient is very young or elderly.

THE PHARMACIST AND THE COMMUNITY

Pharmacists share their knowledge with their own customers; with other health professionals, including physicians and other pharmacists; and with the general public. A pharmacist may participate in public health education programs such as drug abuse prevention, diabetes screening, high blood pressure screening, and disease prevention. Participation could take the form of lectures and panel discussions in community schools.

As members of their community, pharmacists also have opportunities to serve the community in non-health-related areas. Participation in local government, service organizations, churches, youth groups, and other civic activities can also create goodwill for the pharmacist's business.

HANDLING SPECIAL SITUATIONS

As you learned earlier, working in pharmacies is somewhat different from working in other retail businesses in that many of your customers will be ill or have a family member who is ill. Handling customers who are under the stress of illness may require all the customer-relations skills at your disposal.

Pharmacy also differs from other businesses in that it is a highly regulated, legally sensitive profession. The pharmacist and other employees must work within a framework of laws, regulations, and policies that the customer may not always understand. Dealing with a customer who asks you to do something that would violate a law or policy will also require tact.

Sometimes you will have to handle a complaint from a customer. Courtesy and respect will be your most important assets. You can do several things to help ease the situation:

- Listen carefully, and hear the person out. Do not interrupt.
- Let the person vent his or her irritation.
- Express your regret at any inconvenience the customer has experienced, whether you are responsible or not.

Often, the pharmacy worker will be able to help customers with complaints up to a point, and then refer them to the pharmacist for further service.

SUMMARY

All pharmacists and workers in pharmacies are expected to practice ethical, responsible behavior. Ethics are a set of moral principles or values. The Code of Ethics for the American Pharmaceutical Association is presented. Skill in working with people is also important, because everyone who works in a pharmacy contributes to creating a friendly, professional atmosphere. Handling customers who are under the stress of illness or have complaints may require special customer-relations skills.

3

Drug Legislation

Objectives: After completing this unit, you will be able to—

1. *define common legal terms used in pharmacy;*
2. *list three levels of regulations and determine which prevails if there is conflict;*
3. *list and describe the two federal agencies involved with pharmacy and drug regulation and enforcement;*
4. *list and describe two state agencies involved with pharmacy and drug regulation and enforcement; and*
5. *list the categories of scheduled drugs.*

TERMS AND DEFINITIONS

controlled substance or *controlled drug*—any drug or substance subject to any of the controls of the Federal Comprehensive Drug Abuse Prevention and Control Act of 1970 (Public Law 91-513); such drugs or substances are those that are subject to or have a potential for abuse or physical/psychological dependence; the category includes narcotics, amphetamines, barbiturates, and hallucinogens

Drug Enforcement Administration (DEA)—the federal agency within the U.S. Department of Justice charged with enforcing federal drug laws

dispense—to prepare, package, compound, or label for delivery a prescription drug or device in the course of professional practice to an ultimate user or his/her agent by or pursuant to the lawful order of a practitioner

distribute—to deliver a prescription drug or device other than by administering or dispensing

drug—(1) a substance recognized as a drug in the current official United States Pharmacopoeia, National Formulary, Homeopathic Pharmacopoeia, or other drug compendium or any supplement to them; (2) a substance intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease in humans or other animals; (3) a substance, other than food, intended to affect the structure or any function of the body of humans or other animals; (4) a substance intended for use as a component of any articles specified in (1), (2), or (3) above; (5) a dangerous drug; (6) a controlled substance

Food and Drug Administration (FDA)—the agency within the Department of Health and Human Services charged with establishing and enforcing federal food and drug regulations

legend drug—a drug that bears the following federal legend on its original container label: "Caution—Federal law prohibits dispensing without a prescription" or "Caution—Federal law restricts this drug to use by or on the order of a licensed veterinarian"; legend drugs are always synonymous with prescription drugs and prescription-only drugs

over-the-counter (OTC) drug—a drug that can legally be sold without a prescription; OTC drug, nonprescription drug, patent medicine, and proprietary medicine are all terms that indicate drugs or medicines that can be purchased without a doctor's prescription

patron, customer, patient—terms for the person buying and using medicines or drugs

pharmacist, licensed pharmacist, registered pharmacist, druggist, apothecary—terms for a trained person licensed to compound and sell drugs

This unit is an introduction to some of the common legal terms, agencies, and requirements that pharmacy workers need to know and how these affect the daily operation of a pharmacy.

There are three levels of legal requirements and regulations for pharmacy: federal, state, and, in some cases, local. State laws and regulations can be more stringent than federal; local ones can be more stringent than state. If there is a conflict between state and federal law, the stricter law will prevail.

FEDERAL REGULATIONS AND AGENCIES

Food and Drug Administration. The first federal Food and Drug Act went into effect in 1906. After several amendments, it was completely rewritten and reenacted by Congress in 1938. Amendments have placed many drugs under the control of the Food and Drug Administration (FDA), the agency established by Congress to enforce the act.

Areas regulated by the act include: definitions; adulterated drugs, devices, and cosmetics; misbranded drugs, devices, and cosmetics; label, labeling, and advertising requirements; new drug procedures; exemptions and conditions of enjoinment; packaging and repackaging requirements; and criminal and/or administrative remedies.

Of special interest to pharmacists are the changes in the original act, referred to as the Durham-Humphrey Amendments. Under these amendments, drugs fall into two classes: prescription drugs and over-the-counter drugs. The Durham-Humphrey Amendments regulate aspects of dispensing such as telephone prescriptions, record keeping, and refilling of prescriptions.

The FDA has the power to regulate, discipline, and control, but has no authority to inflict punishment or impose penalties. All issues of fact are triable in court, the final disposition being determined according to customary judicial procedure.

Many states have enacted food, drug, and cosmetic acts that closely follow federal law.

Drug Enforcement Administration. The Federal Comprehensive Drug Abuse Prevention and Control Act of 1970 (Public Law 91-513) went into force in 1971. The parts that affect pharmacy practice are referred to as the Federal Controlled Substances Act. The enforcement of this act was given to the Drug Enforcement Administration (DEA), an agency in the U.S. Department of Justice.

The following parts of the act are important to pharmacy and pharmacists:

- Legal criteria for placing drugs in various schedules
- Inventory requirements
- Registration requirements (e.g., types, fees, and renewals)
- Record keeping, all schedules, prescriptions, purchases, and sales
- Schedules of specific drug products
- Order form procedures
- Physical security requirements
- Dispensing procedures for pharmacists: prescriptions, labeling, refills, emergency orders, partial filling, sales to other practitioners, OTC dispensing of Schedule V drugs, and safety closure
- Reporting theft, loss, and destruction
- Transfer procedures and limitations

One important aspect of these laws should be kept in mind by all pharmacy workers. Some Schedule V controlled substances may be dispensed retail without a prescription in some states. However, they can be sold only by pharmacists, and not by nonpharmacist employees, even if they are under the direct supervision of a pharmacist. The DEA can inspect a pharmacy's records of controlled substances during business hours at any time.

STATE REGULATIONS AND AGENCIES

State Boards of Pharmacy. The regulation of the practice of pharmacy is a function of the states, and not of the federal government. It rests upon the power vested in the state to protect its citizens. While the laws regulating pharmacy vary among the states, they are in agreement on the basic principles, purposes, aims, and objectives of pharmacy practice. State pharmacy laws generally regulate

- the educational and experience qualifications that pharmacists must meet at the time of examination or registration.
- the agency, usually known as the State Board of Pharmacy, charged with the enforcement and administration of the law.
- the granting of permits for the conduct of a community pharmacy or drugstore. (In most states, permits are issued for one year, and application must be made for their renewal.)
- the minimum of professional and technical equipment and apparatus that the pharmacy must, at all times, possess.
- the initial licensing of pharmacists by examination.
- periodic reregistration of pharmacists. (In most states, certificates of registration are granted for a period of one year.)
- the conditions under which certificates of registration or store permits may be canceled or revoked.
- the prominent display of the certificate of registration in the store or pharmacy in which the holder is employed.
- penalties for violations. (Infractions of pharmacy laws are punishable by fine in most instances.)
- reciprocal registration.
- the discretion vested in boards of pharmacy. (While the board is authorized to make rules and regulations for the enforcement and administration of the pharmacy law, such rules and regulations must be strictly in accord with the expressed or implied purposes of the law. The board is an administrative, not legislative, agency. It may not exercise any power or authority not clearly delegated to it, or which by reasonable implication is necessary to the proper functioning of the pharmacy law.)
- the sale of proprietary and patent medicines and commonly used household and domestic remedies by dealers other than pharmacists.

Section 19 of the Texas Pharmacy Act states that "a person may not dispense or distribute prescription drugs unless he is a licensed pharmacist or is authorized" by the act.

Department of Public Safety (DPS). This agency in Texas is responsible for the enforcement of Texas drug laws, including rules and regulations relating to the Texas Controlled Substances Act. The DPS works closely with the DEA. It uses the following criteria to classify controlled substances in the state:

Schedule I

a. High abuse potential
b. No accepted medical use in treatment in the United States or lacks accepted safety for use in treatment under medical supervision

Schedule II

a. High abuse potential
b. Has currently accepted medical use in treatment in the United States or currently accepted medical use with severe restrictions
c. Abuse of the substance may lead to severe psychological or physical dependence

Schedule III

a. Less potential for abuse than those listed in Schedules I and II
b. Has currently accepted medical use in treatment in the United States
c. Abuse may lead to moderate or low physical dependence or high psychological dependence

Schedule IV

a. Low abuse potential relative to those in Schedule III
b. Has currently accepted medical use in treatment in the United States

c. Abuse may lead to limited physical or psychological dependence relative to those in Schedule III

Schedule V

a. Low potential for abuse relative to those in Schedule IV
b. Has currently accepted medical use in treatment in the United States.
c. Abuse may lead to limited physical or psychological dependence relative to those in Schedule IV

Pharmacies in Texas are required by law to maintain three separate prescription files. They must keep a file for Schedule II drugs dispensed; a file for Schedule III, IV, and V drugs dispensed; and a file for prescription orders for all other drugs dispensed. The Department of Public Safety can inspect all controlled substances records at any time. The State Board of Pharmacy may inspect any of the pharmacy's records at any time.

Both hospital inpatient and outpatient records come under state law and must comply with requirements of the state board. The same three files must be kept as in retail pharmacies.

In addition to federal and state laws and regulations, there may be local ordinances controlling some drugs.

Pharmacy workers can be very helpful to the pharmacist in keeping records. Pharmacists must keep drug interaction files and patient profiles. Besides the prescription records required by law, there are others that can be useful if available.

SUMMARY

Drug legislation is enacted at three levels—federal, state, and local. The strictest of these regulations prevails. The Food and Drug Administration (FDA) and the Drug Enforcement Administration (DEA) were established by the federal government for control of drugs, devices, and cosmetics. Each state has a Board of Pharmacy to protect its citizens through enforcement and administration of state laws. The Department of Public Safety (DPS) is responsible for enforcement of Texas drug laws based on the classification of controlled substances by schedule. Local ordinances may also control some drugs.

4

Safety

Objectives: After completing this unit, you will be able to—

1. *give the purpose of OSHA;*
2. *discuss hazards in the pharmacy;*
3. *describe the importance of cleanliness in the pharmacy;*
4. *tell how to care for specialized pharmaceutical equipment;*
5. *point out special problems connected with a hospital pharmacy;*
6. *list five general fire safety rules for the pharmacy; and*
7. *list general rules about what to do in the event of a robbery.*

TERMS AND DEFINITIONS

environmental safety—precautions taken against hazards in our surroundings
OSHA—Occupational Safety and Health Administration
safety—freedom from harm or danger
sharps—needles and other sharp objects, such as scalpel blades

Safety means freedom from harm or danger. The numerous potential hazards in the pharmacy range from slipping on a wet floor to armed robbery. Pharmacy workers should be aware of these hazards and the ways of dealing with them. Following a few simple rules will promote your own safety and that of your coworkers and customers.

OSHA

In an effort to ensure safe and healthful working conditions for every worker in this country, the federal government has established general safety rules for employers. These are outlined in the Occupational Safety and Health Act, or OSHA. All employers must conform to OSHA's safety and health standards, which are enforced by the Secretary of Labor. Although OSHA protects workers, pharmacy workers must learn to protect customers and patients from dangers. One way to ensure safety is to develop safety attitudes. Attitudes are learned and can be changed with knowledge and experience.

ENVIRONMENTAL SAFETY

Environmental safety refers to precautions that should be taken against hazards that exist in your surroundings. Environmental hazards in the pharmacy include such things as faulty electrical equipment and wiring, floors wet from spills or leakage, poor lighting, cluttered walkways and work areas, and contact with patients with communicable diseases. All of these can be dangerous to employees in the pharmacy, and some can be dangerous to customers as well.

Any wet substance on floors should be wiped up immediately. In the case of a large spill, the area should be roped off until it dries to prevent someone from slipping (see fig. 1).

Inadequate or improper lighting is also very hazardous. All lighting failures should be taken care of immediately. It is essential to keep the many pieces of electrical equipment functioning properly and safely. Malfunctions should be reported at once.

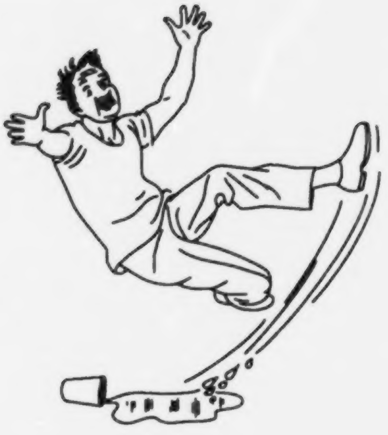


Fig. 1. Wipe up spills immediately.

Improper storage can result in cluttered, unsafe aisles and work areas. All passageways should be kept clear at all times. When you are storing materials, remember not to put things in walkways where fellow employees and patients may be injured by tripping.

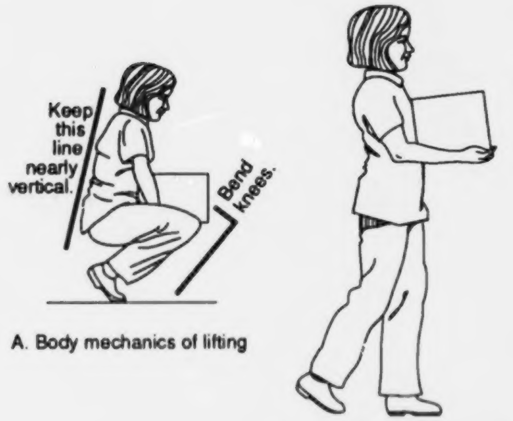
HANDLING MATERIALS

Pharmacy workers need to know how to safely handle the many hazardous materials in the pharmacy. When working with chemicals, wear appropriate protective clothing to prevent eye and skin contact. Always read the label warning for hazardous chemicals before handling them. Hands should be washed at the completion of any procedure involving chemicals. Work areas should be thoroughly cleaned after using chemicals, to prevent accidental exposure to others.

Scheduled and radioactive drugs should be handled and stored according to established procedures. The procedures for storing controlled substances are legislated.

Strains and sprains are also common injuries to pharmacy employees. These injuries most often occur when heavy packages or objects are lifted or carried. Carts should be used whenever possible to transport heavy objects. Remember the proper procedures for lifting heavy objects, as shown in figure 2, A and B.

- Stand close to the object, with your feet apart for balance.
- Bend your knees, and keep the back as straight as possible.
- Get a good grip, and keep the object close to your body.
- If the object is too heavy to handle alone, get someone to help you.


Keep this line nearly vertical.
Bend knees.

A. Body mechanics of lifting

B. Carry objects close to body, and wear closed-toe shoes.

Fig. 2. Handling materials safely

In the pharmacy, it is a good idea for all employees to wear closed-toe shoes. Dropping a gallon bottle of liquid on an exposed toe can do serious damage. Use step stools and ladders properly. Never lean a folding ladder against the wall. The ladder legs must always be fully extended to prevent slipping. Be sure to report all injuries to your supervisor.

CLEANLINESS

Cleanliness in the pharmacy is absolutely essential. Contamination and cross-contamination of some drugs and chemicals can be a very serious health problem. For example, a patient who is allergic to a drug, such as penicillin, could have a serious allergic reaction to a very small amount of the drug. Utensils and equipment used to prepare dosages and prepackaged drugs must be thoroughly cleaned to avoid any possible contamination.

The physical appearance of the pharmacy also can attract or turn away patients and customers.

Many dangerous and potent drugs are stored in the prescription area, and it is usually desirable to keep nonpharmacy personnel out. The best person for the job of keeping the prescription area of a pharmacy clean is the pharmacy worker who is familiar with the materials stored there, the procedures followed, and the equipment used.

EQUIPMENT

Specialized pharmacy equipment needing cleaning and maintenance includes the following:

- Balances and weights
- Tablet and capsule counters
- Ointment slabs and spatulas
- Various types of bottles
- Prepackaging machines
- Sterile equipment and supplies
- Typewriters, FAX machines, computers
- Materials used for bulk compounding
- Cash registers
- Laminar flow hoods in hospitals

You should learn to care for the equipment in the pharmacy where you are assigned.

Workers in community pharmacies may not come in contact with laminar flow hoods. In hospital pharmacies, these are used to help preserve sterility in the preparation of intravenous solutions. They produce very clean and dust-free areas. If your pharmacy uses a laminar flow hood, it should be checked frequently to be sure it is functioning properly.

Many pharmacies supply surgical instruments and supplies to surgeons and other health professionals. They also supply a number of health and prescription accessories to patients. One of your jobs as a pharmacy worker will be to receive and disperse sterile and disposable equipment and supplies, whether you work in a community pharmacy or a hospital pharmacy.

HOSPITAL PHARMACY

The involvement of hospital pharmacy personnel in patient-care areas has increased in recent years. It is very important for these employees to understand the hazards of being exposed to patients with certain problems (e.g., communicable diseases, psychiatric problems). Before entering any patient's room, check for special precautions or warnings. Hospitals generally use color-coded barrier cards on the patient's door. For example, yellow means strict isolation; red stands for respiratory isolation; brown means to observe enteric precautions; and olive indicates wound and skin precautions. AFB Isolation stands for Acid-Fast Bacillus Isolation. Demonstration of these bacteria in a sputum specimen confirms a diagnosis of tuberculosis for that patient. The sign will indicate whether a mask, gown, gloves, or all three are required. If there is any doubt, check with nursing personnel before entering isolation areas.

The Centers for Disease Control and Prevention (CDC) has written precautions to apply in any facility to prevent transmission of infections. These are called Universal Blood and Body Fluid Precautions. They apply when handling any body fluid and especially those that contain blood. All patients and staff are considered possible carriers of potentially harmful pathogens. Follow the policy at the hospital pharmacy with regard to hand washing, isolation, and sharps. *Sharps* are needles and other sharp objects, such as scalpel blades. Handle carefully to prevent puncture wounds. Discard into puncture-proof containers.

FIRE SAFETY

The precautions and procedures that should be exercised in the event of a fire will be somewhat different in each pharmacy. Every employee should be aware of general fire safety rules as well as procedures for their site. Employees should all be aware of how to report a fire and what else to do if a fire breaks out. Larger institutions generally have an evacuation plan for employees and patients. Any pharmacy should have smoking and nonsmoking areas clearly designated.

Remember these general rules for fire safety:

- Fire exits should be clearly marked and free from obstructions.
- Fire extinguishers should be in conspicuous places, properly maintained and serviced. Employees should know how to use them.
- Aisles should be kept free of obstacles and trash. Trash should not be allowed to accumulate.
- All supplies, particularly flammable ones, should be safely stored.
- All combustibles, such as paper, rubbish, cleaning solvents, oily rags, etc., should be kept away from heaters or electrical equipment, where fires can start.

ROBBERY AND THEFT

Procedures for dealing with robbery will also differ from one pharmacy to another. There are, however, certain general points to remember. Pharmacies are particularly vulnerable to theft because of the supply of drugs (primarily scheduled drugs) on hand. Proper security measures are essential in the pharmacy, particularly for controlled substances. Pharmacy workers should discuss with their employers what to do in the event of a robbery. Emphasis should be placed on the protection of lives. You should not try to become a hero. Cooperate in every way with the people staging the holdup. While the robbery is going on, make mental notes on the person's build, hair color, complexion, voice, clothing, and everything else that would help in identification later. Try not to stare at the person while making these mental notes. Although it is difficult to do, remain calm. Do not panic. Do not move anything. The pharmacist will have to count all controlled substances after a robbery or theft.

SUMMARY

Safety is freedom from harm or danger. It can best be achieved by developing safe attitudes and practices toward your surroundings, equipment, and the handling of hazardous materials. Safety also involves knowing and observing the general rules for fire safety and how to react to robbery and theft.

5

Dispensing in the Pharmacy

Objectives: After completing this unit, you will be able to—

1. *give the definition of a prescription;*
2. *name and describe the parts of a prescription;*
3. *identify Latin abbreviations used in prescriptions;*
4. *list the five "rights" of medication dispensing; and*
5. *describe the procedures for handling new and refill prescriptions*

TERMS AND DEFINITIONS

dosage—strength and frequency of medication
inscription—list of ingredients and their quantities used in preparing the prescription
omission—something not done or left out
prescription—an order from a physician for medicine(s)
subscription—directions for the manner of preparation of the ingredients into a form suitable for the patient
superscription—the written letters *Rx*
transcription—directions to the patient; indicated by *Sig*

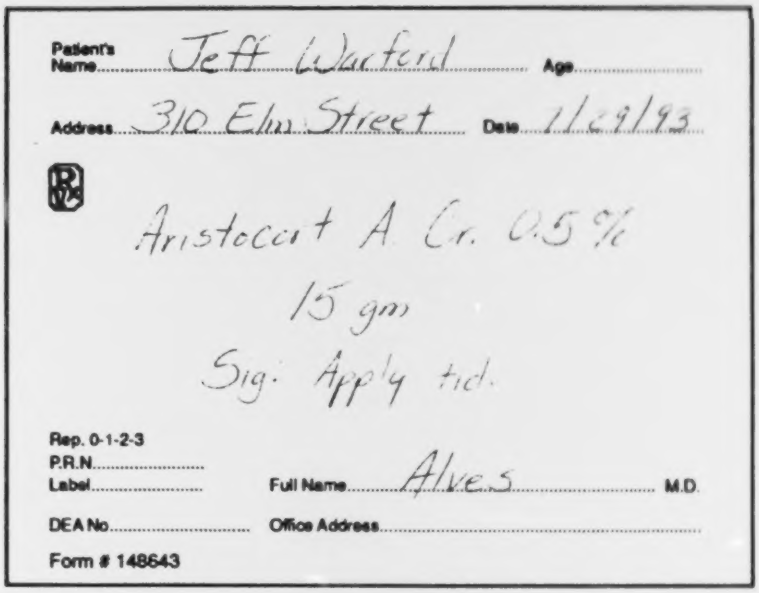
A *prescription* is an order for a medicine or medicines by a physician or other legal prescriber. It may be written, faxed, or called in to the pharmacist over the telephone.

PARTS OF THE PRESCRIPTION

A prescription usually has seven parts. These are illustrated in figure 1.

1. *Name and address of the patient.* By law, the patient's name and address must be on the prescription form. For the completeness and accuracy of the pharmacy's files, it is important to verify the spelling and obtain the patient's telephone number.
2. *Date of prescription.* The date should be on all prescriptions, and is required by law on prescriptions for controlled substances. Some controlled substance prescriptions must be filled within seven days of writing. Controlled substance prescriptions cannot be refilled after six months or five times. The date is also essential for referral when the patient requests a refill for any medication.
3. *Superscription.* This is the term for the written letters *Rx.* It is the symbol for the Latin word *recipe*, which means, "take thou," or "you take."
4. *Inscription.* This is a list of the ingredients and their quantities to be used in preparing the prescription. In some instances it may be merely the generic or trade name of a manufactured drug.
5. *Subscription.* This is the set of directions to the pharmacist for the manner of preparation of the ingredients into a form suitable for the patient.
6. *Transcription.* This consists of the directions to the patient, normally indicated by *Sig.*
7. *Physician's signature.* This must be present on all written prescriptions to make them valid.

Modern medical practice in this country is to write prescriptions entirely in English. Drug quantities are shown in the metric system of weights and measures. However, you will find that many physicians still use the traditional Latin pharmacological terms and abbreviations



Patient's Name Jeff Warford Age

Address 310 Elm Street Date 1/29/93

℞

Aristocort A Cr. 0.5%

15 gm

Sig: Apply tid.

Rep. 0-1-2-3

P.R.N.

Label

Full Name Alves M.D.

DEA No.

Office Address

Form # 148643

Fig. 1. A prescription from Dr. Alves for Jeff Warford

on their prescriptions. Because Latin is a dead language, the meaning of its words does not change. It is also the universal language of medical science, so a prescription written in Latin can be comprehended in any developed country in the world.

Table 1 is a list of some of the terms and Latin abbreviations with which you should be familiar.

HANDLING PRESCRIPTIONS

Some general procedures for handling new prescriptions will be the same no matter what type of pharmacy is involved. The process begins when the written prescription is taken from the patient by the pharmacist or a pharmacy worker. Only a pharmacist can take phone prescriptions. The worker or pharmacist must be certain that the patient's name and the name of the physician are legible and correct. The patient's correct address is required by law to be written on the prescription when it is presented. The patient's address and phone number are used to identify the patient in the computer. The phone number is essential for refills, in case the pharmacist needs to contact the patient when the prescription is not refillable. It is also useful in telling apart people with the same last names.

Ask whether the doctor indicated that a less expensive generic drug could be used. Determine whether the patient wants to use one, if it is available.

When the customer/patient indicates payment will be made by a third party, ask for the insurance card and also record her/his date of birth.

The next step is for the pharmacist or a technician to prepare the label for the prescription. The "errors and omissions" part of the procedure for filling the prescription takes place next. The pharmacist compares the label with the original prescription to make sure that the drug and the dosage (both the strength and frequency of medication) are correct. At this time the pharmacist should be able to evaluate whether there are any possible drug interactions or contraindications.

When the label is typed correctly, the pharmacist finally goes through the technical process of *compounding,* or selecting the prescribed medicine. The pharmacist must attach the label to the container. The last and perhaps most

TABLE 1
Latin Terms and Abbreviations

i	one
ii	two
iii	three
iv	four
ʒi, dr, 5cc	1 teaspoonful
ʒss, ssdr	1/2 teaspoonful
ʒss, ss oz, 1/2 oz, 15cc, 16cc	1 tablespoonful
oz, 30cc	2 tablespoonfuls
aa	each
ac	before meals
a.d.	right ear
a.s.	left ear
a.w.	both ears
b.i.d.	twice daily
BP	blood pressure
c, w/	with
cap	capsule
cc	w/meals, cubic centimeters, milliliters
gm, g	gram
gr	grain
gtt, gtts	drop, drops
h, hrs, degree symbol (°)	hours
hs	at bedtime
IM	intramuscularly
IV	intravenously
mg, mgm	milligram
N and V	nausea and vomiting
o.d.	right eye
o.s., o.l.	left eye
O.T.O.	one time only
o.u.	both eyes
p.c.	after meals
p.o.	by mouth, orally
p.r.	rectally
prn	as needed
p.v.	vaginally
q	every
q.d.	every day, daily
q.h.	every hour
q.i.d.	four times daily
q.o.d.	every other day
q.s.	quantity sufficient, as much as needed
sb, sublingual, SL	under the tongue
sig.	write
s.o.b.	shortness of breath
ss	one-half
stat	at once, now
tab	tablet
TAT	till all taken
t.i.d.	three times daily
ud, ut dict	as directed
UF	until finished

important step in handling prescriptions is to see that the correct medicine with the correct label is dispensed to the correct person.

Five "rights" must always be considered when dispensing medication:

- The ***right patient***
- The ***right drug*** or ***drugs***
- The ***right dose*** or strength of medication
- The ***right route*** of administration (orally, rectally, eye, ear, etc.)
- The ***right intervals*** (before meals, every four hours, four times daily, etc.)

The completed prescription may be given to the pharmacy worker to hand to the patient, handed to the patient by the pharmacist, or filed in a bin to be picked up by the patient later. The patient and pharmacist may confer when the pharmacist presents the filled prescription to the patient. The patient should be made to feel free to ask questions about the prescription at any time, and the pharmacist should answer them as fully as possible. The pharmacist may also refer the patient to the prescribing physician for some answers.

REFILLS

The procedures for handling refill prescriptions will also be similar in most pharmacies. A patient will either call in a refill or bring in the prescription container to be refilled. To refill the prescription you need to know the patient's name, the prescription number, the physician's name, and the patient's phone number. The phone number is needed in case the pharmacist must call back to verify something or the prescription is not refillable.

If refills are not authorized on the original prescription, the pharmacy must call or fax the physician's office for approval. Computerized records provide fast access to the necessary information.

TRANSFERS

There are also standard procedures for handling a prescription being transferred to your pharmacy from the pharmacy where it was originally filled. The patient should call the pharmacy to which they want their prescription transferred. For a transfer you need to know the patient's name, the prescription number, the other pharmacy's phone number or fax number, and the patient's phone number. The pharmacist will call the original pharmacy for the prescription information and the last refill date. The pharmacist must then call the physician for authorization to refill the prescription. By law, transfers of prescriptions must be from pharmacist to pharmacist, not to a computer.

MAINTENANCE PRESCRIPTIONS

A patient with a chronic condition will sometimes have a maintenance prescription on file at the pharmacy. These are also sometimes referred to as *prn* (as needed) prescriptions. The patient will come in periodically or as needed for an automatic refill. This can present a problem to the pharmacy worker. The American Medical Association and the American Pharmaceutical Association now require a prescription to be limited in time to one year since the original was written, six months for controlled substances, or in the number of refills. After this limit is reached, the pharmacist must call the physician for authorization to refill, or the patient must see the physician again.

Patients who do not know about the limit on their standing prescriptions may be displeased when they find that the prescription can no longer be filled automatically. They may need medical tests before authorization can be given. The physician may need to change the dosage or the type of medication to prevent long-term side effects. The pharmacy worker must learn to deal with these patients thoughtfully and tactfully.

OTHER PRESCRIPTION INFORMATION

The pharmacy worker has other opportunities to help patients with information about their course of medication. Some patients may not know that they should get a refill before they run completely out of medicine. A patient with a prescription that hasn't been filled in over two years should always call the physician. If the patient has medication left from an old prescription, it should usually be thrown away, because it will be of no use.

Out-of-state prescriptions can be filled legally in Texas, unless the prescription is for a controlled substance. An out-of-state prescription for a controlled substance can be filled if the prescription is handwritten. The pharmacist must follow normal procedures for handling the transfer (e.g., calling the physician for refill authorization).

The patient should keep prescription receipts for insurance and income tax purposes. These receipts are also helpful if the patient loses or throws away the prescription container and then needs to have the prescription refilled.

Finally, you can make the patient aware that some prescriptions may take longer to fill. A medication that must be compounded or one that is to be billed to a third party (e.g., Pharmaceutical Card System [PCS], Paid Rx, etc.) will take more time to process. The pharmacy worker should notice whether compounding will be needed for any prescriptions when the patient hands them in.

SUMMARY

Physicians order medicines for their patients by writing a prescription. The prescription usually has seven parts—the name and address of the patient, date of the prescription, superscription, inscription, subscription, transcription, and physician's signature. A label is prepared for a drug container and checked for accuracy. The medication is added and dispensed to the patient. Pharmacy workers need to recognize Latin terms and abbreviations commonly used in pharmacies. Procedures for refills, transfers, and maintenance prescriptions are standardized and regulated. The pharmacy worker must learn to deal tactfully with patients who are not aware of restrictions.

6

Materials Management

Objectives: After completing this unit, you will be able to—

1. *discuss the questions a pharmacy worker should keep in mind when checking in a new shipment;*
2. *describe methods of storage for drugs and pharmaceutical supplies in the pharmacy work area and the bulk storeroom;*
3. *list the temperature ranges used in temperature control;*
4. *give the standards for the different drug containers;*
5. *discuss what is meant by repackaging, prepackaging, and unit-dose packaging; and*
6. *discuss the three drug distribution systems employed in hospitals.*

TERMS AND DEFINITIONS

centralized hospital pharmacy—a pharmacy whose services are provided from one location

container—something that holds a drug or medication directly

deliquescence—melting or dissolving of a substance due to absorption of moisture

efflorescence—loss of water because of crystallization, causing a substance to change to powder

evaporation—loss of moisture to the atmosphere

expiration date—the date after which a drug should not be used

hermetic container—container impervious to air or other gases

materials management—the handling of drugs and related products from the time they enter the pharmacy until they are dispensed

packaging—placing a prescription into the proper container or repackaging from a bulk supply

satellite hospital pharmacies—pharmacies that provide services from different areas to a specific set of patients

Materials management or drug distribution is the handling of drugs and related products from the time they enter the pharmacy until they are dispensed, either to a customer or in a community pharmacy or to a work unit in a hospital, such as a nursing station. By their nature, pharmaceutical materials require care in receiving, storing, packaging, labeling, and distributing.

RECEIVING DRUG DELIVERIES

The pharmacy worker should examine every delivery to the pharmacy from manufacturer or local wholesaler with a number of questions in mind:

- *Has the shipment arrived at the right place?* You can save time by catching misdeliveries before you open the container.
- *Is the shipping container intact?* There should be no evidence of damage, spillage, or external exposure to moisture.
- *Does the packing slip agree with the contents of the shipment?* Check for brand or generic names, number of items, strengths, and dosage forms. Many drugs come in a variety of forms, so it is important to make sure that the shipper has packed the correct ones.

- *Does the packing slip agree with the original purchase order?* Compare names, numbers, strengths, and dosages, and any other descriptive information on the forms.
- *Are all the items in the shipment in good condition?* Glass containers, particularly vials and ampules, break easily. Tablets can be crushed or powdered. Liquids can spill.
- *Have you missed anything?* Exercise great care in unpacking and checking incoming stock. Some drugs are very expensive and may be packed in very small containers.

Price merchandise as it is checked in. The price label usually indicates the cost per unit, source of supply, date of purchase, and the selling price. Much of this is in code, and you should be familiar with the code for your pharmacy. Once new stock is checked in, initial and date the accompanying invoices. There are generally two people responsible for each order—the worker who checked the order and the pharmacist to whom the worker reports.

Pharmacy workers should be familiar with all the stock on the shelves in both the prescription area and the over-the-counter area. A good way to become familiar with all the stock and learn drug and accessory names is to periodically dust all the stock. At the same time, the pharmacy worker can also check to make sure that fresher stock is behind older stock on the shelf. This is to ensure that older stock is used before it can go out of date.

STORAGE

Many drugs and pharmaceutical supplies, because of their very nature, require special storage conditions. Some drugs and chemicals are affected by light, heat, moisture, and contact with other chemicals. Special containers and controlled storage conditions are essential in preserving drug integrity.

The storeroom must be clean, well ventilated, well lighted, temperature controlled, and relatively free of moisture. Drugs and supplies should be stored off the floor on shelves or pallets. Drugs should be stored so that they are easy to find, in both the bulk storeroom and the prescription area (see fig. 1). This can be done in a number of ways:

- Alphabetically according to drug name, usually by generic name (e.g., aspirin, furosemide)
- Alphabetically according to dosage form (e.g., capsules, syrups, tablets)
- Alphabetically according to manufacturer (e.g., Abbott, Lederle, Lilly)
- Any working combination of the above

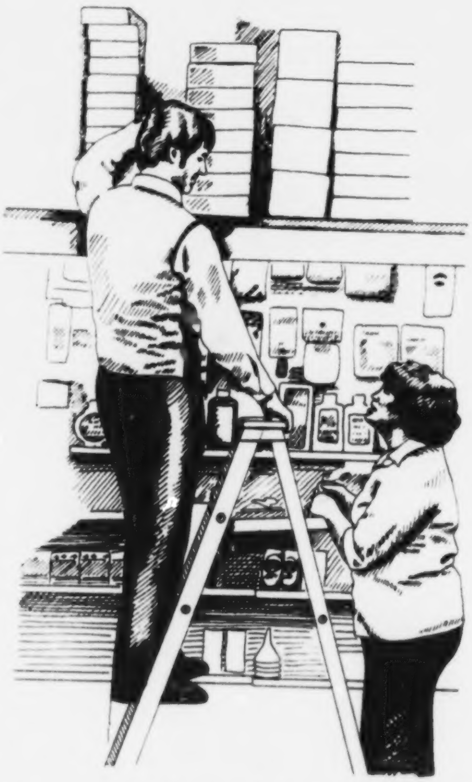


Fig. 1. Drugs and drug products should be stored where they are easy to find.

The United States Pharmacopoeia has established temperature ranges to define the terms used in temperature control.

Cold is any temperature not over 8°C (46°F). A *refrigerator* is a cold place in which the temperature is kept between 2° and 8°C

(36° and 46°F). A *freezer* is a cold place in which the temperature is kept between −20° and −10°C (−4° and 14°F).

Cool is any temperature between 8° and 15°C (46° and 59°F).

Room temperature is the temperature prevailing in a working area. Controlled room temperature is a temperature kept between 15° and 30°C (59° and 86°F).

Warm is any temperature between 30° and 40°C (86° and 104°F).

Excessive heat is any temperature over 40°C (104°F).

DRUG CONTAINERS

A *container* holds a pharmaceutical article and is or may not be in direct contact with the article. Containers can be made of cardboard, paper, plastic, or glass. Standards have been officially established for containers.

A *light-resistant container* protects the contents from the effects of light by preventing all or some of the light from passing through.

A *well-closed container* protects the contents from extraneous solids and from loss of the contents during ordinary handling, shipment, storage, and sale.

A *tight container* protects the contents from contamination by liquids, solids, and vapors and from loss due to efflorescence, deliquescence, or evaporation under ordinary conditions.

A *hermetic container* is impervious to air or any other gas under ordinary conditions.

A *single-dose container* is a single-unit container for articles intended for parenteral administration only.

A *unit-dose container* is a single-unit container for articles intended for administration other than parenteral as a single dose.

A *multiple-unit container* permits withdrawal of portions of the contents without changing the strength, quality, or purity of the remaining contents.

A *multiple-dose container* is a multiple-unit container for parenterally administered articles only.

CAPS AND LIDS

All caps and lids must be childproof, unless specifically requested by customer or patient, preferably in writing.

PACKAGING

Packaging has three aspects: prescription filling, prepackaging, and unit-dose packaging.

Prescription filling. Part of the procedure in filling a prescription is to package it in the appropriate size and type of container.

Prepackaging. *Prepackaging* is the process of repackaging drugs from bulk supplies into specified quantities for dispensing. One way of prepackaging is to package drugs from large bulk supplies into amounts that are usually prescribed. This saves time in counting or pouring for each individual prescription.

Unit-dose packaging. Another type of prepackaging is repackaging drugs into *unit-dose packages.* Each package contains one dosage (one tablet, capsule, teaspoonful, etc.). This type of prepackaging is used widely in hospitals and nursing homes. Many products can be purchased from the manufacturer in dispensing sizes or unit-dose packages. Some companies specialize in only unit-dose packaging from bulk supplies.

Prepackaging in your pharmacy will require the same careful attention to detail and accuracy as the dispensing process. Also, a control system must be used so that the manufacturer, the lot number, the expiration date, the person who repackaged the product, the date of repackaging, and the pharmacist supervisor can be identified.

Each container of prepackaged medication should be labeled with the following information: name of pharmacy, name of the drug product with strength and dosage form, amount present, pharmacy control number, and expiration date (if any). Each pharmacy has its own policies and procedures for prepackaging and labeling.

HOSPITAL PHARMACY DISTRIBUTION

Medications given to patients in a hospital are usually distributed in one of three ways, or in a combination of these ways.

Floor stock system. A supply of drugs is kept at the nursing station and automatically replaced by the pharmacy as the drugs are used. The advantages of this type of distribution system are that the drugs are available when needed, and the pharmacy does not have to label or charge for them. The disadvantages of this type of system include the need for a large drug inventory, increased medication errors, missed charges, more pilferage, and less drug control. Since the pharmacist does not see the original physician's order or the nurse's transcription, a double-check system is not in force. This can be a very serious problem with the large number of potentially dangerous drugs with names that look and sound alike.

Individual prescription or individual requisition system. Every medication a patient receives requires a requisition or an individual prescription. There is no medication at the nurse's station, with the exception of emergency drugs. The advantages of this system include requiring a smaller inventory, less pilferage, and fewer missed charges. The disadvantages probably outweigh the advantages. There are higher chances of medication errors, wastage due to discontinuing drugs and patients being discharged, improper labeling, and loss of control. This system is not very practical or efficient, and few hospitals use it.

Unit-dose system. This system is probably the most desirable, and more and more hospitals are converting to it. Unit-dose medications are ordered, packaged, handled, administered, and charged in units containing enough of the drug for one regular dose, application, or use. The pharmacy worker often assists in the dispensing of unit-dose medications by setting up the dose carts. The medications are then checked by the pharmacist before they go to the patients. The advantages of the unit-dose system include good drug control, no slippage, minimum number of errors, and ease in keeping records. The disadvantages of the system are the possible need for longer pharmacy hours and the need for unit-dose equipment such as medication carts and prepackaging machines. Since not all products are commercially available in unit doses, special repackaging equipment is required.

A hospital pharmacy may operate either as a centralized pharmacy or as decentralized (satellite) pharmacies. A *centralized pharmacy* provides all of its services from one location in the hospital. Decentralized or *satellite pharmacies* provide services from different areas to a specific set of patients. For example, in a large hospital, there may be a satellite pharmacy on each floor, serving certain wards (e.g., pediatric satellite, obstetrics-gynecology satellite, surgery satellite).

THE UNIT DOSE IN COMMUNITY PHARMACIES

In the community pharmacy, legend drugs are dispensed only on a prescription presented by the patient. The distribution system is not as variable as it is in hospitals. However, some community pharmacies might use hospital distribution methods, such as the unit-dose system, in providing drugs to health facilities such as nursing homes.

SUMMARY

Materials management is the handling of drugs and related products from the time they enter the pharmacy until they are dispensed. As shipments are received, they must be examined carefully to ascertain that the order has been filled correctly and delivered undamaged. The pharmaceutical supplies must be stored under proper conditions and arranged for easy access. Containers must meet officially established standards. Drugs may be repackaged to fill a prescription or into unit doses or the amounts usually prescribed. Hospital medications can be distributed by the floor stock system, individual requisition system, unit-dose system, or a combination of parts of these systems.

7

Metrology

Objectives: After completing this unit, you will be able to—

1. *discuss the systems of weights and measures used in pharmacy;*
2. *identify the symbols and abbreviations of the weights and measures used in pharmacy;*
3. *convert numbers from Arabic to Roman and Roman to Arabic; and*
4. *perform simple calculations that will be required of a worker in the pharmacy where you are working.*

TERMS AND DEFINITIONS

decimal fractions—fractions in which the fractional part is expressed in multiples of ten

fractions—representations of parts of a whole

metric system—a system of measurement based on the number ten

metrology—the science of weights and measures

percentage—parts per hundred

ratio—the relationship between two substances with respect to the number of times one is contained in the other

From manufacturing drugs to dispensing prescriptions, three considerations must be foremost in the pharmacy worker's mind—the nature of the drug itself, the strength of the drug, and the amount of the medication. Each dose of medication is mixed to an exact strength of active ingredient. Each prescription is measured out in an exact number of doses. Pharmacy workers use numbers and calculations at almost every step of drug preparation and dispensing as they carry out those measurements.

METROLOGY

Metrology is the science of weights and measures. In this unit you will be introduced to the systems of measurement used in pharmacy. It is not possible in this manual to acquaint you with all the new terms and calculations you may encounter in the pharmacy.

Four measurement systems are used in pharmacy: the apothecary system, the avoirdupois system, the metric system, and the common household system. It is important for the pharmacy worker to understand the relationships between the four systems, and to be able to make accurate and precise measurements in all four. In many cases, people's lives depend on the drugs they are taking. A decimal point can mean the difference between a correct dose and a lethal dose. The special and exact meaning of every symbol of measurement must be correctly interpreted for the same reason.

ROMAN NUMERALS

You are familiar with Arabic numbers (1, 2, 3). However, in scientific language, including pharmacy terminology, Roman numerals are often used. Physicians sometimes use Roman numerals on prescriptions. Some Roman numerals and their Arabic equivalents are given below:

Roman Numeral	*Arabic Numeral*
I	1
II	2

III	3
IV	4
V	5
VI	6
VII	7
VIII	8
IX	9
X	10
L	50
C	100
D	500
M	1,000

As you see, combinations of I, V, and X indicate the numbers from 1 to 10. To write any number, you combine two or more digits and add them up if they are the same or successively smaller, like this:

II = 1 + 1 = 2
VII = 5 + 1 + 1 = 7
XXX = 10 + 10 + 10 + = 30
LXX = 50 + 10 + 10 = 70
LVII = 50 + 5 + 1 + 1 = 57

Sometimes a number is written with two or more digits successively larger. You determine the number by subtracting the preceding smaller digits from the successive larger one, thus:

IX = 10 − 1 = 9
XL = 50 − 10 = 40
XC = 100 − 10 = 90
CD = 500 − 100 = 400

Using these two rules, we can convert the following Roman numerals into their Arabic equivalents:

XCIX = 99
CLXXIII = 173
CDVIII = 408
MCMLXXXII = 1,982

This ancient system of numbers is used in the pharmacy profession mainly on prescriptions. You will see both uppercase and lowercase Roman numerals on prescriptions:

Rx
Librium Caps 10 mg
XXX
Sig. i PO TID

Rx
Ampicillin Caps 250 mg
XL
Sig. i PO q 6 hr.

APOTHECARY SYSTEM

The *apothecary system* of weights and measures was brought to America by English colonists. Apothecaries adapted or developed their units of measurement over the years according to their needs, without concern for uniformity. As a result, the units in the apothecary system have no simple, consistent relationship to each other as do those of other systems.

The symbols used in the apothecary system, with their equivalents, are as follows:

Apothecary Weight

1 (scruple) = 20 grains (gr)
1 (dram) = 3 scruples = 60 grains
1 (ounce) = 8 drams = 480 grains
1 (pound) = 12 ounces = 5,760 grains

(Note that grain is abbreviated *gr,* and must not be confused with the abbreviation for gram, which is *g.*)

Apothecary Fluid Measure

1 (minim) = 1 drop (approximately)
1 (fluidram) = 60 minims
1 (fluidounce) = 8 fluidrams = 480 minims
1 pint (pt) = 16 fluidounces
1 quart (qt) = 2 pints = 32 fluidounces
1 gallon (gal) = 4 quarts = 8 pints = 128 fluidounces

(Note that different-sized droppers will have slightly different drops.)

AVOIRDUPOIS SYSTEM

The *avoirdupois system* of weight is used in commerce and industry in the United States. It is sometimes used in the buying and selling of drugs and chemicals, particularly bulk quantities for later manufacturing and/or dispensing. Following are the terms and abbreviations for avoirdupois weights. Note that the grain is the only unit that is identical in the apothecary and the avoirdupois systems of weight.

Avoirdupois Weight
1 ounce (oz) = 437 1/2 grains (gr)
1 pound (lb) = 16 ounces = 7,000 gr

METRIC SYSTEM

The preferred scientific system of weights and measures is the *metric system*. The metric system, in fact, is the official household system of weights and measures in many countries. The United States is officially in the process of converting to the metric system, although it will be many years before it is in wide household use. In pharmacy, the metric system is used more often than any of the other systems.

The metric system is a decimal system of weights and measures, which means that all the units of the system are multiples of ten. The metric system is composed of three primary units: the *meter* (length), the *liter* (volume), and the *gram* (weight).

Each primary unit is divided into 10, 100, or 1,000 secondary units. Secondary units that are larger than the primary units are multiples of 10, 100, or 1,000. The smaller units are expressed by Greek and Latin prefixes to the primary unit's name. These are referred to as decreasing prefixes. The common decreasing prefixes are *deci-* (1/10), *centi-* (1/100), *milli-* (1/1,000), and *micro-* (1/1,000,000). The larger units are expressed by adding Greek increasing prefixes. Increasing prefixes include *deca-* (10), *hecto-* (100), and *kilo-* (1,000). You should be able to see the relationships of the units.

Metric Length
1 meter (m) = 100 centimeters (cm)
1 m = 1,000 millimeters (mm)
1 kilometer (km) = 1,000 m
1 cm = 10 mm
1 cm = 0.01 m

Metric Weight
1 gram (g) = 1,000 milligrams (mg)
1 kilogram (kg) = 1,000 g
1 milligram (mg) = 0.001 g

Metric Volume
1 liter (l) = 1,000 milliliters (ml)
1 ml = 0.001 l
1 l = 10 deciliters (dl)

HOUSEHOLD MEASURES AND CONVERSIONS

In determining doses of medications for patients, pharmacists and other practitioners sometimes use terms of household measurement. The quantities have been established by custom to have the following equivalents in the apothecary and metric systems:

1 tumblerful ≅ /℥viii ≅ 240 ml
1 teacupful ≅ /℥iv ≅ 120 ml
1 tablespoonful ≅ /ʒiv ≅ 15 ml
1 teaspoonful ≅ /ʒi ≅ 5 ml

You should note that the actual household measurements are often approximations. In many cases household teacups, tablespoons, and teaspoons have been found to hold about 25 percent more than the amounts established by custom. Patients should be aware of these differences and be provided with measuring devices that will deliver a precise amount of medicine.

There are other commonly used conversions you should learn. These are as follows:

Linear Measure
1 meter (m) = 39.37 inches
1 inch = 2.5 centimeters (cm)

Liquid Measure
1 milliliter (ml) = 16.23 minims
1 fluid ounce (/℥) = 30 ml (29.57 ml)
1 liter (l) = 38.8 oz
1 pint (pt) = 473 ml
1 gallon (gal) = 3,785 ml

Weight
1 kilogram (kg) = 2.2 pounds (lb)
1 pound (lb) = 454 grams (g)

1 ounce avoir. (oz) = 28 g (28.35 g)
1 ounce apoth. (℥) = 31 g (31.1 g)
1 g = 15.432 grains (gr)
1 gr = 65 milligrams (mg)

The pharmacy worker must understand all these systems to avoid confusion when intermixing different systems.

CALCULATIONS USING FRACTIONS

The pharmacy worker will be doing many calculations involving fractions. *Fractions* represent parts of a whole. Common fractions have two parts and are written thus:

$$\frac{3}{4} \qquad \frac{\text{numerator}}{\text{denominator}}$$

As the numerator increases, the fraction becomes larger, and as the denominator increases, the fraction becomes smaller. For example, 3/5 is larger than 2/5, and 1/10 is smaller than 1/5. Thus, tablets labeled 1/2 gr are 100 times more potent than tablets labeled 1/200 gr.

Decimal fractions are ones in which the fractional part is expressed in multiples of ten. As we have noted, the placement of the decimal point is critical to accurate measurement. A decimal point error in the calculation of a dose of a drug can be fatal to the patient.

When you look at a decimal fraction from right to left, each place represents an increase by a factor of ten of the place preceding it. Figure 1 shows a number with the value indicated according to placement within the number.

CALCULATIONS USING RATIOS

Ratio refers to the relationship between two substances with respect to the number of times one is contained in the other. The strengths of very diluted preparations are very often expressed in terms of ratio strength (e.g., epinephrine, 1:1,000). This means that there is one part of active ingredient (in this case, epinephrine) in 1,000 parts of the final preparation. Ratio strength can designate a concentration of liquids and solids in three ways:

1. As a liquid preparation containing a solid in a liquid—weight/volume ("Epinephrine, 1:1,000" would be a gram of epinephrine in 1,000 milliliters of final solution.)
2. As a liquid preparation containing a liquid in a liquid—volume/volume ("Alcohol, 1:1,000" would be 1 ml of alcohol in 1,000 ml of final solution.)
3. As a solid preparation containing a solid in a solid—weight/weight ("Atropine, 1:10,000 in lactose" would be 1 gram of atropine in 10,000 grams [10 kg] of final mixture with lactose.)

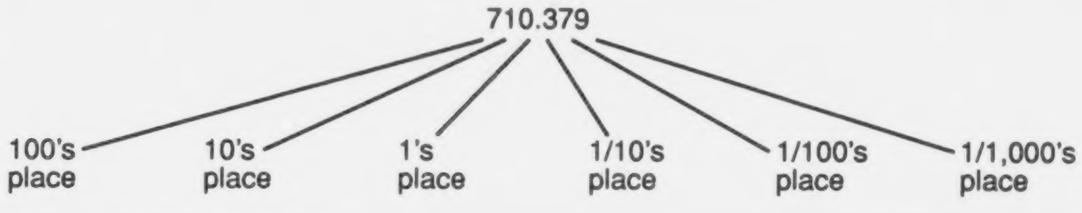


Fig. 1. Placement in decimal fractions indicates value.

CALCULATIONS USING PERCENTAGES

Another way of expressing the strength of a drug or chemical in solution is by percentage. *Percent* means parts per hundred. A percent solution will be so many parts of active ingredient per 100 parts of final solution.

- A 10% solution is 10 parts per 100 final parts, or 1 part per 10 final parts.
- A 0.1% solution is 0.1 parts per 100 final parts, or 1 part per 1,000 final parts.

COMPARISON OF CALCULATIONS

Each system of calculation expresses the same quantity in a different way. The solution of 2.0 grams in a liter of solution would be expressed as a fraction (2/1,000 or 1/500) or by the decimal 2.0 g in 1,000 ml. The solution ratio is 2:1,000 and its percentage is 0.2%.

SUMMARY

Metrology is the science of weights and measures. Four measurement systems are used in pharmacy: the apothecary system, the avoirdupois system, the metric system, and the common household system. Calculations are expressed in fractions, by ratios, or by percentages. Pharmacy workers use numbers and calculations at almost every step of drug preparation and dispensing as they carry out measurements for prescriptions.

8

Managing a Pharmacy

Objectives: After completing this unit, you will be able to—

1. *define management;*
2. *name the functions of management;*
3. *discuss the basic functions of an organization;*
4. *describe the functions of computers in pharmacy;*
5. *list components needed for data processing; and*
6. *determine the data included in a patient profile.*

TERMS AND DEFINITIONS

communication—sending and receiving messages
computer—an electronic device used to store, organize, and retrieve data
control—a device to keep a business running smoothly
data processing—the performance of clerical procedures by computers
display—a screen used for temporary viewing of data stored in a computer
hard copy—data printed on paper
management—a series of activities directed toward achieving certain objectives
memory—the place where data is stored in a computer's main unit
modem—a device for converting electronic signals from one form to another
patient profile—a listing of a person's medical information and drug history
peripheral device—hardware that allows computers to communicate or adds an auxiliary function
window—the area of data viewed on a computer display at one time
working capital—money to carry on the day-to-day activities of a business

Management can be defined as a series of activities directed toward achieving certain objectives. It can also be defined as the process of effectively coordinating the efforts of a group whose members have at least one common goal. Finally, management can be more simply defined as the art of getting things done through other people.

FUNCTIONS OF MANAGEMENT

Management can be divided into five main functions. These are planning, organizing, directing, communicating, and controlling.

Every phase of a business operation requires *planning*. Overall objectives are planned. Sales and budgets are planned. Personnel needs and expenses are planned. Once a plan has been put into effect, there must be constant follow-through. If a plan is not going well, alternative decisions must be made. The decision-making process never stops.

Any business must be *organized* for work. The manager must decide who will do what tasks, or who will be responsible for what areas of the operation. An organization chart may be required. As conditions change, the organization will need to be reviewed to see if it is still working or if it needs changing. The flow of work must be watched so that it is done efficiently.

Directing includes supervision, but it also means delegating authority and responsibility for getting jobs done. The manager is like the conductor of an orchestra. There is a plan, and an organization to carry out that plan, and the manager sees to it that all the employees are functioning in their jobs as required.

A vital skill in managing is *communicating.* A good manager must be able to receive as well as send messages. It is important to make people understand what you expect of them and to listen to what they have to say to you. The most common form of communication is oral. It is personal, and it provides instant feedback. More can be communicated orally because tone of voice and body language give us information beyond the words that are spoken. The pharmacist must get out from behind the prescription counter and work with employees whenever possible.

A business without good *controls* soon gets into serious difficulty. There must be controls on expenses, on purchasing and inventory, and on personnel. Some controls can be flexible, but others must be rigidly maintained. A *control* is a device to keep the business operating smoothly. If it is limiting or hampering efficiency, it needs to be removed or reset.

BASIC FUNCTIONS OF AN ORGANIZATION

Any organization that provides goods or services to the public must perform at least seven basic functions.

Recruit employees. The purpose of the recruiting process is to provide a large enough group of applicants that qualified people can be hired. For the average pharmacy, sources of potential employees include: high schools (vocational programs), colleges, placement centers, neighborhood word-of-mouth advertising, newspaper ads, and current and former employees.

Develop human resources. A new employee needs to know the policies and procedures of an organization. *Orientation* is the planned introduction of employees to their jobs, their coworkers, and the organization. An orientation procedure is the first step in a good training program.

Training programs provide employees the opportunity to learn new skills and ideas so that the organization develops internal talent for the future. New employees need to be taught specific and immediately usable skills. They need to acquire general knowledge for future and long-term applications. Ongoing employee training should also be a learning process for acquiring skills, knowledge, concepts, and attitudes to help in the achievement of specific goals. Time spent training employees is time well spent. Training can contribute to higher production, fewer mistakes, and lower turnover among employees. Effective training is an investment in the human resources of an organization.

A worker's performance should be continually evaluated, either through formal performance appraisals or through informal personal judgments. Appraisals should be made at least every six months for hourly employees. When an employee's performance is questionable, it should be evaluated more often. The employer needs to let employees know how they are performing. People need to know when they are doing a good job as well as when the job they are doing is below standard.

An important part of employee relations is employee counseling. Counseling may take the form of coaching. This is a day-to-day effort by management to help workers perform at their top ability. Coaching also emphasizes improvement. Counseling may also be concerned with making employees aware of problems and helping them to upgrade their performance.

The employee-relations climate in a pharmacy is an important part of the overall atmosphere. The attitudes and behaviors of the pharmacist and the other pharmacy workers are relayed to the consumer. You can tell the difference between a situation in which people are working together as a team and one in which they are not.

The secret of the successful pharmacy is the people who work there. The strength of any business lies with the confidence and dedication of the employees. Employees who are treated as "partners" will usually become dedicated to achieving the same goals as their employer. Maintaining a free and open exchange of information will help resolve problems promptly and fairly.

Secure financial resources. *Working capital* is the money available to carry on the day-to-day activities of the pharmacy. Working capital is needed to pay the suppliers, meet the employee payroll, and pay the rent and utilities. A successful pharmacy must have a good supply of working capital.

Acquire supplies and goods for sale. A profitable and successful pharmacy must acquire and maintain a profitable level of inventory. The pharmacy must purchase the right amount of the proper merchandise, at the best time, at the best price. Successful purchasing begins by identifying the needs of the pharmacy's patrons, patients, and prescribers. It also helps to check merchandise stocked by other pharmacies in the same trade area. The pharmacist must also regularly read the professional journals to keep up with new products and product changes. Drug wholesalers can also be helpful in merchandise selections.

Organize the capabilities of the human resources. In addition to hiring and training employees, a good manager will find out which people are best suited to which tasks. The person who runs the pharmacy will also often work with others who provide goods and services, such as a banker, an accountant, an attorney, an insurance agent, a professional wholesaler, and drug manufacturers. These important goods and services should be provided by people the pharmacist or manager knows to be competent and reliable. Good managers will organize these human resources as carefully as they organize those inside the pharmacy.

Meet the customer's or patient's needs. The customer is looking for a product, or wants a prescription filled, and expects courteous, efficient service. If these expectations are disappointed, the customer will go somewhere else next time. The purposes of the other functions of a business are to anticipate and fulfill these needs.

Plan for the growth of the organization. The successful pharmacy manager plans the growth of the pharmacy. Most often, growth is centered around the increase in sales and profits. A pharmacy must continue to grow to ensure prosperity and success.

Most managers work out their plan for growth around the past history of the pharmacy. The manager looks at revenues and expenses to set goals that are reasonable and attainable. Once the pharmacist has developed a plan, usually based on a fiscal year, the actual figures must be compared to those in the proposed plan. The successful pharmacy will meet or exceed the plan through cost management.

COMPUTERS

A *computer* is an electronic device used to store, organize, and retrieve data. Data is placed on a disk/diskette at a terminal, where it is organized for storage. Data can be recalled and displayed in a window on a screen. A *display* is the screen used for the temporary viewing of data stored in a computer. A *window* is an area of data viewed on the screen at one time.

A data processing system consists of three basic parts: hardware, software, and the auxiliary equipment to accompany both of these.

The *hardware* consists of (1) a central processing unit (CPU) with a (2) keyboard and (3) screen or display. A (4) printer is attached to produce *hard copy* (data printed on paper). Components may all be separated or combined into a console, depending on the manufacturer. Components are illustrated in figure 1. The CPU must have a disk drive and a memory. *Memory* is the place where data is stored in the computer's main unit. The keyboard resembles that of a typewriter but with additional keys. The screen looks like the one on a television set. The printer is located close to or away from the other three hardware components. It may be a dot matrix or a laser printer. The size and style of the printed material is determined when an operator selects a font (print size and style) from the menu appearing in the display window.

Peripheral devices are added to the data processing system. They are considered to be hardware. A *peripheral* is a device that (1) allows the computer to communicate or (2) adds auxiliary functions. Peripherals connect computers to each other in a network to exchange input and output and thus communicate between pharmacies. A *modem* is a device for converting electronic signals from one form to another. A computer can be connected to a telephone by a

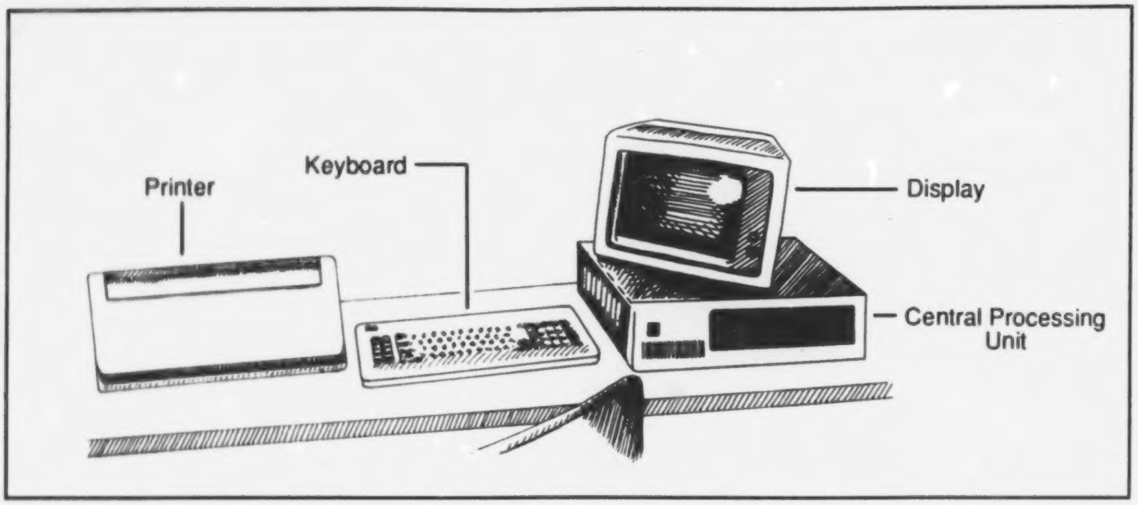


Fig. 1. Components of a computer

modem for transmission of data along telephone lines to another computer. When a modem is added, it is said to interface with the computer. ***Interface*** means that the modem is linked to a computer and is under its control. Peripherals are separated from the computer but connected by a cable or wires. A printer may be considered a peripheral device.

Software is the name applied to the programs, disks, and operation manuals. ***Auxiliary equipment*** is not part of the computer but is necessary to operate the system efficiently. The auxiliary item may be a device or consumable supplies, such as zigzag-folded computer paper, insurance forms, labels, and plain paper. Stands, storage cases, covers, and cables are considered to be auxiliary equipment.

TYPES OF COMPUTERS

There are three types of computers—mainframes, minicomputers, and microcomputers. All operate in the same way, in general.

Mainframes are vast, expensive computers found in large facilities, such as colleges, universities, research facilities, and corporations. They require special environmental conditions, special wiring, and trained operators. One mainframe computer is used as a central processing unit (CPU) for many workstations.

Minicomputers are smaller, do not require special conditions or wiring, and perform many of the same functions as mainframes. *Microcomputers* are used in small businesses, schools, and homes. These perform the data processing functions but lack the memory of the larger models. Personal computers (PCs) fall into this category. Pharmacies may use either of the last two types.

DATA PROCESSING

Data processing refers to the performance of clerical procedures by computers and is widely used in pharmacy. Computer programmers have worked with mathematics and logic to break down clerical procedures so that they are compatible with the capabilities of the computer. Programmers have adapted procedures for pharmacy in recording, arranging, storing, and retrieving data. A patient's or customer's record can be put into the computer's memory for storage and future use. Other functions include preparing patient profiles, inventory control, time management, and flagging for special conditions, such as allergies. Labels, letters, and bills are prepared by computers. Programs are available to complete calculations using equations, formulas, or conversions. Computers can assist automatic stop-order policy through flagging or shutdown when standard refill numbers or time periods are violated. Third-party information can be stored for reference.

Third-party information refers to insurance coverage. The three parties involved are (1) the purchaser, (2) the insurance company or Medicare, and (3) the supplier—in this case, the pharmacy. The patient/customer (purchaser) is the first party. The insurance company is the carrier, the insurer, the administrative agent, or the second party. The third party is the provider or pharmacy.

PATIENT PROFILES

Patient profiles are entered and stored in a data-processing system for rapid recall. A ***patient profile*** is a listing of a person's medical information and drug history. Hospitals may require a pharmacist to compile this on the initial admission, thus enabling a pharmacist to find drug duplications, harmful potential drug interactions, overlapping therapy, and contraindications due to sensitivity, allergy, or disease. A complete profile should include:

1. patient's name, address, telephone number, age, and sex
2. admitting physician's name, hospital number, and location in the facility
3. provisional and confirmed diagnosis
4. allergies and sensitivities
5. drug history obtained during an interview
6. weight of patient
7. names of prescription and nonprescription drugs used, with strength, dosage, date, and initials of dispensing pharmacist
8. intravenous therapy
9. laboratory date on drug cultures and sensitivities or electrolytes
10. special dietary requirements
11. additional data relating to diagnosis or therapy

SUMMARY

Management uses a series of activities to achieve certain objectives. The functions of management are planning, organizing, directing, communicating, and controlling all phases of the pharmacy. The organization that comprises a pharmacy must perform at least seven basic functions: recruit employees, develop human resources, secure financial resources, acquire supplies and goods for sale, organize the capabilities of the human resources, meet the customer's or patient's needs, and plan for the growth of the organization. Data processing (performance of clerical procedures by computers) is widely used in pharmacy. The processing system consists of hardware, software, and the auxiliary equipment to accompany both of these. Patient profiles are entered, stored, and easily retrieved from computers.

9

Names, Sources, and Dosages of Drugs

Objectives: After completing this unit, you will be able to—

1. *differentiate between the chemical, generic, and trade names of drugs:*
2. *discuss the sources of drugs;*
3. *describe the dosage forms used in dispensing drugs;*
4. *discuss the factors that must be taken into account when determining the dose of a drug for a patient;*
5. *differentiate between a drug's action and its effects;*
6. *describe the basic mechanism of drug action;*
7. *discuss the use of diagnostic aids; and*
8. *describe, in general terms, interactions between drugs.*

TERMS AND DEFINITIONS

agonist—a drug that reacts with a receptor to initiate a response

antagonist—a drug that reacts with a receptor to prevent a physiological activity

contraindication—a symptom or circumstance that makes a particular treatment or procedure inadvisable; e.g., penicillin is contraindicated for someone who is allergic to it

disease—any abnormal body condition that impairs normal functioning

indication—a symptom or circumstance that indicates the advisability of a specific medical treatment or procedure; e.g., a headache indicates the use of aspirin

receptor—a specific cell constituent with which a drug interacts to produce its effects

suppository—medicated substances molded for insertion into a body cavity

symptom—any manifestation of an illness or a condition experienced by an individual

syndrome—a set of symptoms and signs that occur together with reasonable consistency, characterizing a particular abnormality

tablet—an oral dosage form in which ingredients are molded or compressed

Medicine, dentistry, nursing, and pharmacy—all science and health-oriented professions—must use terms that have very precise meanings. You will be seeing these terms throughout the rest of this manual, and you should know the definitions.

DRUG NAMES

Generally, drugs have three different names. These are the chemical name, the generic name, and the trade or brand name.

All drugs are chemicals. The *chemical name* indicates what a drug is made of and how it is molecularly structured. Chemists and other scientists need this information in their work. Pharmacy workers do not need to know specific chemical names for all drugs, but they should be aware that they exist. For example, 4 *acid-chloro-N-furfuryl-5-sulfamoyl-anthranilic* is a chemical name.

The *generic name* is a drug's official common name. This name is often derived from the chemical name. It is selected and agreed upon by the manufacturer and the United States Adopted Names Council (USANC). Generic names are simpler to remember and pronounce than are chemical names of drugs. For example, *furosemide* is a generic name.

The *trade* or *brand name* is the name given the drug by the manufacturer. It is a registered trademark, and the manufacturer has exclusive rights to use it. A particular generic drug can have many trade names, each registered by a different manufacturer. The manufacturer promotes and markets that trade name, so it is usually short and simple to remember. For example, *Lasix* (Hoechst) is a trade name.

The three examples above are the chemical, generic, and trade names for the same drug, a potent diuretic.

Products that are combinations of two or more active ingredients will generally have a trade name, but not necessarily a generic name. Each specific active ingredient will have a generic name. For example, Bactrim (Roche) and Septra (Burroughs Wellcome) are trade names for a combination of sulfamethoxazole and trimethoprim.

SOURCES OF DRUGS

Where do drugs come from? They come from a great variety of sources. In the not-too-distant past, all drugs were products of nature. A *natural product* can be extracted from the source and used as it is, with no further chemical manipulation. Some drugs are natural products of plants, like morphine from the opium poppy. Others come from animals, like insulin from the beef or pork pancreas. Penicillin is a natural product of several different molds. Many drugs are made from other microorganisms, such as bacteria and viruses.

Some drugs are entirely manufactured, starting with simple chemicals. Such drugs are called *synthetic* or *synthetically produced agents.* Most drugs in use today are completely synthetic.

Sometimes the chemicals used to make drugs are natural products themselves. By chemically adding to or subtracting from a natural product, other new drugs are produced. When such chemical alteration of a natural substance yields an active drug, the product is called a *semisynthetic drug* or a *semisynthetically produced agent.* Many of the penicillins in use today are semisynthetic. The original penicillin molecule can be modified to yield a number of different types of penicillin.

Another source of drugs is *minerals*, such as calcium carbonate, sodium chloride, and others, including elements such as iron and sulfur.

Biotechnology-derived drugs consist of drugs that are synthesized by living cells in a controlled environment. These drugs are generally proteins and have high specific activity.

DOSAGE FORMS

The effectiveness of a drug is determined by a number of factors. One of the factors to consider is the dosage form in which the drug is administered. Drugs are dispensed in the three basic physical states—solids, liquids, and gases. Many drugs can be used in more than one of these physical forms. Among other things, the dosage form affects the rate at which the drug is absorbed (enters the circulatory system). Figure 1 shows dosage forms grouped by physical state.

Solid dosage forms. Drugs in the solid state are usually administered by mouth, topically, or by suppository. Tablets and capsules are by far the most common oral dosage form for solids. Tablets come in a variety of sizes, weights, and shapes. *Tablets* are molded or compressed, and they contain either pure or diluted active ingredients.

The form of a tablet is determined by the type of medication and the route of administration. Tablets with more than one active ingredient are manufactured by compressing the component ingredients in layers. Most *compressed* tablets are swallowed whole with water and dissolve in the stomach. Sometimes tablets are coated either to mask a bad taste or to keep the tablet from dissolving before it reaches the intestines (enteric coating).

Other types of tablets are *hypodermic* tablets (dissolve rapidly in liquid for administration with a syringe) and *sublingual* tablets (dissolve under the tongue). Some manufacturers have given trade names to their tablets that are made in distinctive forms (e.g., Diskets, Tabloids, Infatabs, Caplets).

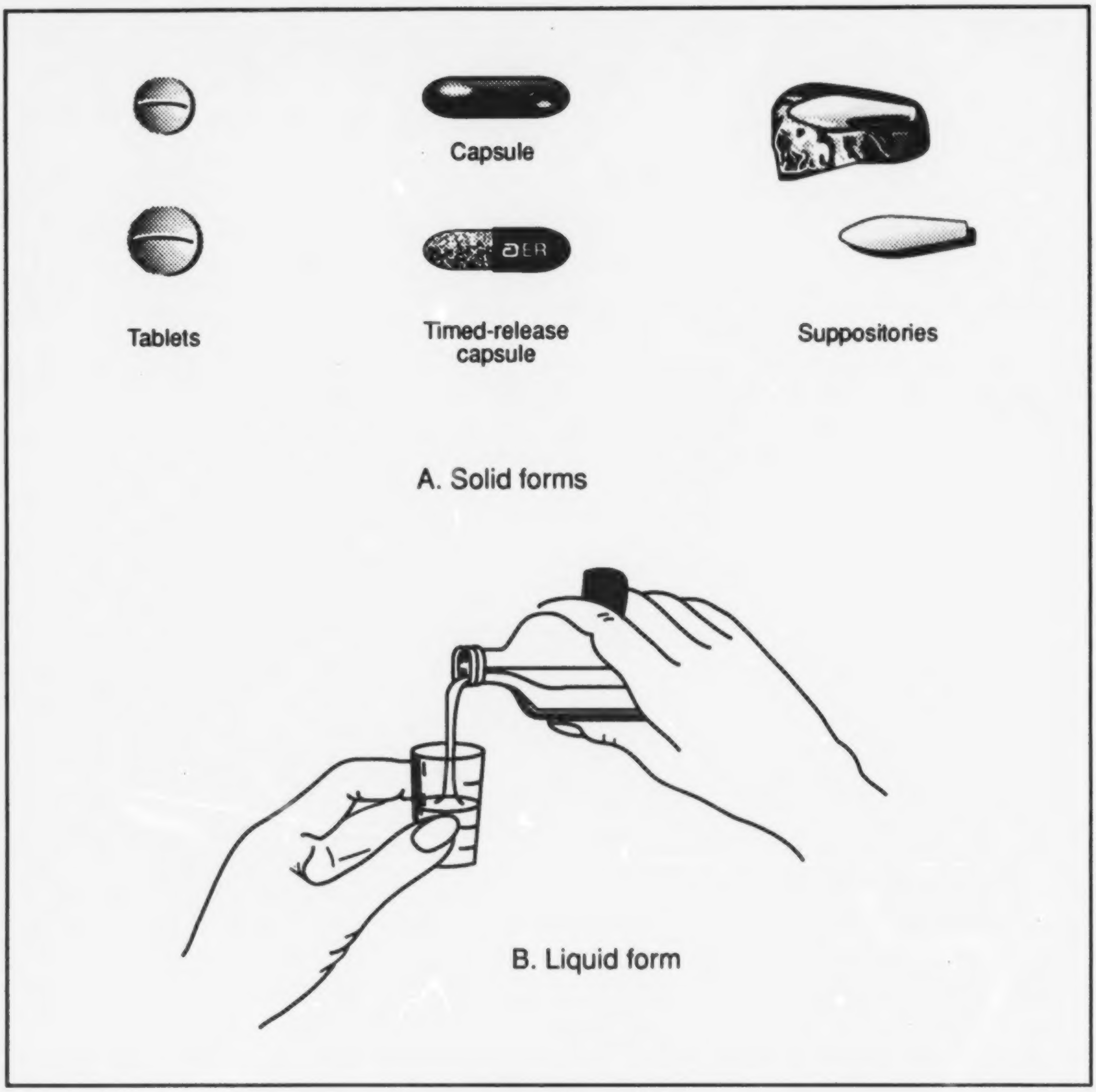


Fig. 1. Dosage forms of drugs

Solid dosages for oral use can also be administered in a *capsule*. Capsules are small, oblong, hard, or soft containers, usually made of gelatin, containing a medication. They release the medication by melting in the stomach. Capsules eliminate the taste and/or odor of drugs by enclosing the ingredients in an almost tasteless shell. Capsules can also be used to prolong the release of medication into the bloodstream. The contents can be in pellets, which dissolve at different rates. These capsules are called timed-release or prolonged-release capsules. Distinctive capsular designs are also sometimes trade-named (e.g., Kapseals or Spansules).

Solid dosages can also be administered *topically*. Generally, this route of administration is for drugs that are used externally and are not absorbed into the body. Ointments and creams are several of the topical dosage forms.

Some solids are administered as suppositories. ***Suppositories*** are usually medicated substances molded for insertion into a body cavity. They melt at body temperature or dissolve in body fluids. Some suppositories may also be specially prepared tablets and capsules.

Liquid dosage forms. Liquid medications can be administered by mouth, by injection, or topically. Drugs are usually absorbed most rapidly from the gastrointestinal tract if they are in liquid form to begin with. Liquid dosage forms are usually easier to swallow, making them particularly useful for older and very young patients. The types of liquid dosage forms are these:

- *Solution*—one or more soluble chemicals (drugs) usually dissolved in water
- *Syrup*—a concentrated solution of sugar in water to which medicinal ingredients are added (Many syrups contain flavoring agents to make them taste better.)
- *Suspension*—finely divided particles of insoluble chemicals (drugs) suspended in a suitable liquid vehicle
- *Emulsion*—a water preparation in which fats or oils are suspended with the aid of emulsifying agents (Emulsions are liquid-liquid preparations. Suspensions are solid-liquid preparations.)
- *Elixirs*—clear, sweetened solutions made from alcohol and water with medication added
- *Tinctures*—solutions made from plant extracts or chemical substances dissolved in alcohol or alcohol and water

Since the active ingredients of suspensions and emulsions are insoluble, they must be shaken well before use to distribute the active ingredients evenly throughout the mixture.

Gaseous dosage forms. Because of their gaseous nature, some medications are administered through inhalation. An aerosol mist can be inhaled into the respiratory tract, including the lungs. For certain conditions, such as bronchial constriction due to asthma, this is the preferred drug form and route. Anesthetics are administered in the gaseous form. Inhalers and vaporizers are methods of delivery for gaseous medications.

DETERMINATION OF DOSAGE

An important consideration for determining the effectiveness of a drug in a particular patient is the size or strength of the dose. Some of the factors that play a role in determining dosage are discussed below.

Age of the patient. The usual dose for a drug is based on the patient's being an otherwise healthy adult between the ages of 20 and 60. Infants and small children usually require a smaller dose, because they are physically smaller, and they may be more sensitive to drug effects. Because their body systems are not fully developed, children should not be considered as merely little adults when it comes to dosing. Aged patients may also require a different dose because of their impaired ability to inactivate or excrete drugs due to age or illness. There are many formulas for calculating dosages in children and elderly patients.

Size of the patient. The ratio between the body weight of a patient and the dose of a drug determines how concentrated the drug will become in the body. For overweight or underweight individuals, the normal dose may have to be modified. Some clinicians feel that dosage can be modified more accurately if body surface area, rather than body weight, is used in the calculation. Body surface area is also very useful in determining pediatric doses for many drugs.

Disease state and physiological condition of the patient. Usual doses of drugs are for normal adults. Many people taking medication fall outside that category, however. Physiological factors other than the condition under treatment may indicate prescribing a drug other than the one that would normally be used. For example, some drugs are contraindicated for pregnant women because they may harm the woman and/or the unborn infant. Another example is prescribing for patients with kidney problems. Some antibiotics that are normally excreted by the kidneys may accumulate in a patient with impaired kidney function and approach toxic levels in the body. A drug is also contraindicated when the patient is known to be allergic to it.

Time of administration. This consideration is very important for effective dosing of drugs. Proper spacing of dosages maintains optimal levels of the drug in the blood. Oral drugs can be taken on an empty stomach (e.g., one hour before meals or two hours after meals) to ensure rapid absorption. An irritating drug can be taken with meals so that the food will act as a buffer. The overall effects of a drug should also be taken into account. Some drugs are best taken at night, when there is less activity on the part of the patient and side effects may not be as bothersome.

Route of administration. This is another very important consideration in determining the dose of a drug. Since the rate and the amount of absorption for a given drug differ with the route of administration, dosage must be modified accordingly. You will study routes of administration in detail later in this manual.

Fate of the drug in the patient. The liver and the kidney are the two major organs involved in ridding the body of foreign substances such as drugs. The functioning of these two organs must be determined in order to appropriately dose drugs in patients. If a drug is metabolized (inactivated) very slowly by the liver, it will tend to accumulate in the body. This accumulation can result in drug toxicity. The dose and frequency of administration must be adjusted to take this into account. The same is true for the kidney excretion of a given drug.

DRUGS AND BODY RESPONSES

Actions and effects. The pharmacist must always keep in mind the action of a drug on the body and the body's response or reaction to the drug. At first glance, these may appear to be the same, but they are really two separate phenomena. *Actions* of a drug are the processes, either biochemical or mechanical, by which the chemical constituents of the drug produce responses or reactions in living organisms. The observed responses or reactions are referred to as the drug's *effects*. Take the diuretic furosemide (Lasix) as an example. The drug's *action* is to prevent sodium and chloride reabsorption by the kidneys; the *effect* is a diuresis (increased passing of water).

Primary and secondary effects. One basic concept of pharmacology is that *no drug produces a single effect*. The *primary* effect of a drug is the therapeutic effect desired, and is usually the reason for prescribing the drug. *Secondary* effects are all of the other effects produced by the drug. These secondary effects may be desirable or undesirable, depending on the patient's situation and the objective of therapy. Sometimes a drug's secondary effects (also called side effects) can be of primary therapeutic interest. For example, the antihistamine diphenhydramine (Benadryl) produces sedation or sleepiness as one of its side effects. Benadryl is sometimes used as a sleep aid, to take advantage of this particular side effect.

Drugs act in one of two general ways—systemically or locally. ***Systemically acting drugs*** must first be absorbed into the bloodstream. From there they are distributed throughout the fluids of the body, eventually reaching the site(s) of action. ***Locally acting drugs*** produce their effects at the site of application or administration. These drugs will exhibit local effects, unless some of the drug is absorbed. In that case, they may cause some systemic side effects.

Mechanisms of drug action. The effects observed in people following the administration of a drug are the result of some kind of interaction between the drug chemical and some part of the organism. This interaction can be specific or nonspecific.

In the *specific type* of interaction, it is generally agreed that a drug receptor is involved. A *receptor* is a specific constituent of a cell with which the drug interacts to produce its characteristic effects. Specific receptors have been identified for only a relatively small number of drugs (e.g., narcotics, some bronchodilators, and antihistamines). Once a drug has attached itself to the receptor, the drug may either initiate a response or prevent a physiological activity from occurring.

When a drug initiates a response, it is called an ***agonist***. When a drug prevents a physiological activity, it is called an ***antagonist***. For example, antihistamines are antagonists to the normal body chemical, histamine. The terms agonist and antagonist should only be used for those drugs that have a specific interaction with a receptor.

Receptors are located throughout the body, and they can be involved in a number of body responses. Some drugs interact with more than one receptor. These drugs are said to lack receptor selectivity.

Nonspecific mechanisms of action can be classified as follows:

- *Drugs acting on enzymes.* Many drugs act on intracellular enzymes to interfere with normal cell metabolism, which in turn produces the effects of the drug.
- *Drugs acting as antimetabolites.* Compounds formed during normal cell metabolism are called *metabolites.* They are converted into other metabolites until a metabolite that the body will use for some purpose is produced. Because of their chemical similarity to intermediate metabolites, some drugs can interfere with these normal reactions. The end product is then a counterfeit metabolite, which the body can't use. Many anticancer drugs act as antimetabolites to kill the cell.
- *Drugs acting as chelating agents.* Some drugs interact chemically with metallic ions in the body. These are called *chelating agents.* These chelating agents combine with ions such as mercury, lead, copper, and zinc. Such drugs are particularly useful as antidotes in the treatment of heavy-metal poisoning. Other drugs in this class may chelate with trace minerals in the body to interfere with metabolic functions that normally require the presence of the particular metal ion.
- *Drugs acting on cell membranes.* The cell membrane plays an essential role in the selective passage of certain materials (e.g., ions, nutrients, and other essential compounds) into and out of the cell itself. Normal membrane function is essential to normal cell function. By interfering with the membrane, some drugs affect cell function to produce their effects.

DIAGNOSTICS

Diagnostic aids are considered drugs and are used to differentiate a number of similar diseases. Examples include the various agents used as contrast mediums and radioisotopes.

Contrast mediums are substances used to aid in the visual examination of internal organs. Examples include barium sulfate, iopanoic acid (Telepaque), and metrizamide (Amipaque).

Radioisotopes are used in the treatment of some tumors and are also used as diagnostic agents to help locate tumors. Examples include the radioactive isotopes of iodine (I^{131}, I^{125}), phosphorus (P^{32}), gold (Au^{198}), and cobalt (Co^{57}, Co^{60}). Many other diagnostic aids can be purchased without a prescription, but they are beyond the scope of this manual.

DRUG SAFETY

No drug is completely safe. There is always the possibility that some of the effects produced by a drug may be harmful to the patient. In therapeutics, the risks of a drug's use must always be compared to its benefits. This is the risk-to-benefit ratio for the drug. We would hope that this ratio is always very small. This is not always the case, however. In determining a risk-to-benefit ratio, you must look at all a drug's effects, both beneficial and adverse. Toxicities must also be considered. These can be exaggerated primary or secondary effects that are harmful.

One potential risk factor is very often overlooked. Drugs can interact with other drugs the patient is taking, with foods, and even with the patient's disease state. We have mentioned some of the aspects of drug-food and drug–disease-state interactions. Here we are concerned with drug-drug interactions.

Drug-drug interactions are possible when more than one drug is taken by a patient. A *drug-drug interaction* occurs when one drug interferes with another. Since multiple-drug taking is common, the potential for significant drug-drug interactions is very high. These interactions, like the side effects mentioned earlier, can be either beneficial or harmful. Drugs can interact with each other by one or more of the following mechanisms:

- Increased or decreased absorption
- Increased or decreased distribution throughout the body
- Increased or decreased drug metabolism

- Increased or decreased excretion
- Additive effects
- Antagonist effects

Drug-drug interactions are a very complex area in pharmacology, and a full treatment is beyond the scope of this publication. Consider the number of drugs available today in the United States, and then consider the potential for drug combinations. The number of potential drug-drug interactions is astronomical. For this reason, a thorough knowledge of pharmacology in the area of drug-drug interactions is essential.

SUMMARY

Drugs have three different names. These are the chemical name, the generic name, and the trade or brand name. The source from which a drug comes can be natural, synthetic, semisynthetic, or mineral. Drugs are dispensed in liquid, solid, or gaseous states. The dosage of a drug should be determined by consideration of the patient's age, body size, disease state, the time and route of administration, and the fate of the drug in the patient. Once within the patient's body, a drug can produce primary or secondary effects and act locally or systemically. The interaction is either specific or nonspecific. Diagnostics are also considered drugs. No drug is completely safe, so the risks of a drug's use must be compared to its benefits.

10

Routes of Administration

Objectives: After completing this unit, you will be able to—

1. *discuss five considerations used to determine the best route of administration for a drug;*
2. *identify and define the routes of drug administration;*
3. *list advantages and disadvantages of the routes of administration; and*
4. *give examples of medications administered by each route of administration.*

TERMS AND DEFINITIONS

buccal—pertaining to the cheek region
CNS—central nervous system; the brain and spinal cord
drug administration—the manner in which medication is applied or introduced into the body
intra-arterial—within an artery
intravenous—within the veins
mucous membranes—membranes lining body passages and cavities opening to the outside
oral—by mouth
parenteral—given by means of a hollow needle
peritoneum—the membrane lining the abdominal cavity and covering the viscera
pleura—membrane covering the lungs
subcutaneous—beneath the skin layers
sublingual—below the tongue

Drug administration is the manner in which medications are applied or introduced into the body.

CONSIDERATIONS OF THE DRUG

Five considerations generally determine the best route of administration for a drug:

- *A drug's chemical properties.* Some drugs don't go into solution very readily, so they have to be compressed into tablets or put into capsules.
- *A drug's physical properties.* Liquid chemicals may have to be made into liquid dosage forms to be taken either by mouth or by injection.
- *Site of desired action.* In respiratory patients, for example, a drug may have to be inhaled to get to the site of action rapidly.
- *Rapidity of response desired.* Intravenous administration generally offers the most rapid response rate and is useful for emergency drugs, for example.
- *Patient's general condition.* If a patient is unconscious or otherwise unable to take anything by mouth, an injection may have to be used.

A drug can be administered by one of seven general routes: oral, parenteral, topical, and rectal administration; applications to the mucous membranes; sublingual and buccal administration; and inhalation.

ORAL ADMINISTRATION

Administration of drugs *by mouth* (orally) is usually the safest, most economical, and most convenient means of administration. It is usually the preferred route of administration if no alternate routes have distinct advantages. Oral administration usually means that a longer time will be needed before the drug exerts its action. It is not used if a patient is vomiting or cannot take anything by mouth.

Depending on the chemical and physical characteristics of a drug, it can be absorbed through the entire length of the gastrointestinal tract from the mouth to the anus. Some disadvantages of the oral route of administration are that (1) irritating drugs can cause nausea and vomiting, (2) many drugs are destroyed by enzymes in the gastrointestinal tract, (3) food sometimes interferes with absorption, and (4) patients may be uncooperative. Tablets, capsules, and suspensions are examples of drugs administered orally. Refer to figure 1A.

PARENTERAL ADMINISTRATION

Parenteral administration is the administration of drugs by means of a hollow needle. There are many different types of parenteral administration. The major ones are discussed below.

Intravenous administration is injection of a drug directly into a vein. It is preferred when it is desirable for a drug to enter the circulatory system rapidly. In some instances, as in the induction of surgical anesthesia by a barbiturate, the dose of the drug is not predetermined but is adjusted to the response of the patient. Some advantages of this route, besides the rapidity of drug response, are (1) the lack of absorption problems, (2) the capability of exact dosing, and (3) the fact that large volumes can be introduced. Certain irritating solutions can be given only in this manner, for the blood vessel walls are relatively insensitive, and the drug, if injected slowly, is greatly diluted by the blood. Some disadvantages are that (1) once injected, the drug cannot be recalled, (2) sterility is essential, and (3) the drug must be completely dissolved in solution. Serious problems could ensue if any solid particles are injected intravenously. Examples of IV drugs are thiopental sodium (Pentothal) and epinephrine. Figure 1B shows intravenous administration.

Intra-arterial administration is similar to intravenous, except that the drug is injected into an artery instead of a vein. This is intended as a means of localizing a particular drug in a specific organ or tissue. Examples are some anticancer drugs and diagnostic agents.

Intramuscular administration is injection of a drug deep into muscle tissue. Drugs in aqueous solution are rapidly absorbed after intramuscular injection. Very slow, even absorption can result from the intramuscular site if the drug is in an oil solution or suspended in various other vehicles. Irritating substances can sometimes be administered by this route also. Great care must be taken to avoid accidental intravenous injections with intramuscular dosage forms. An example of intramuscular injection is the penicillin shot.

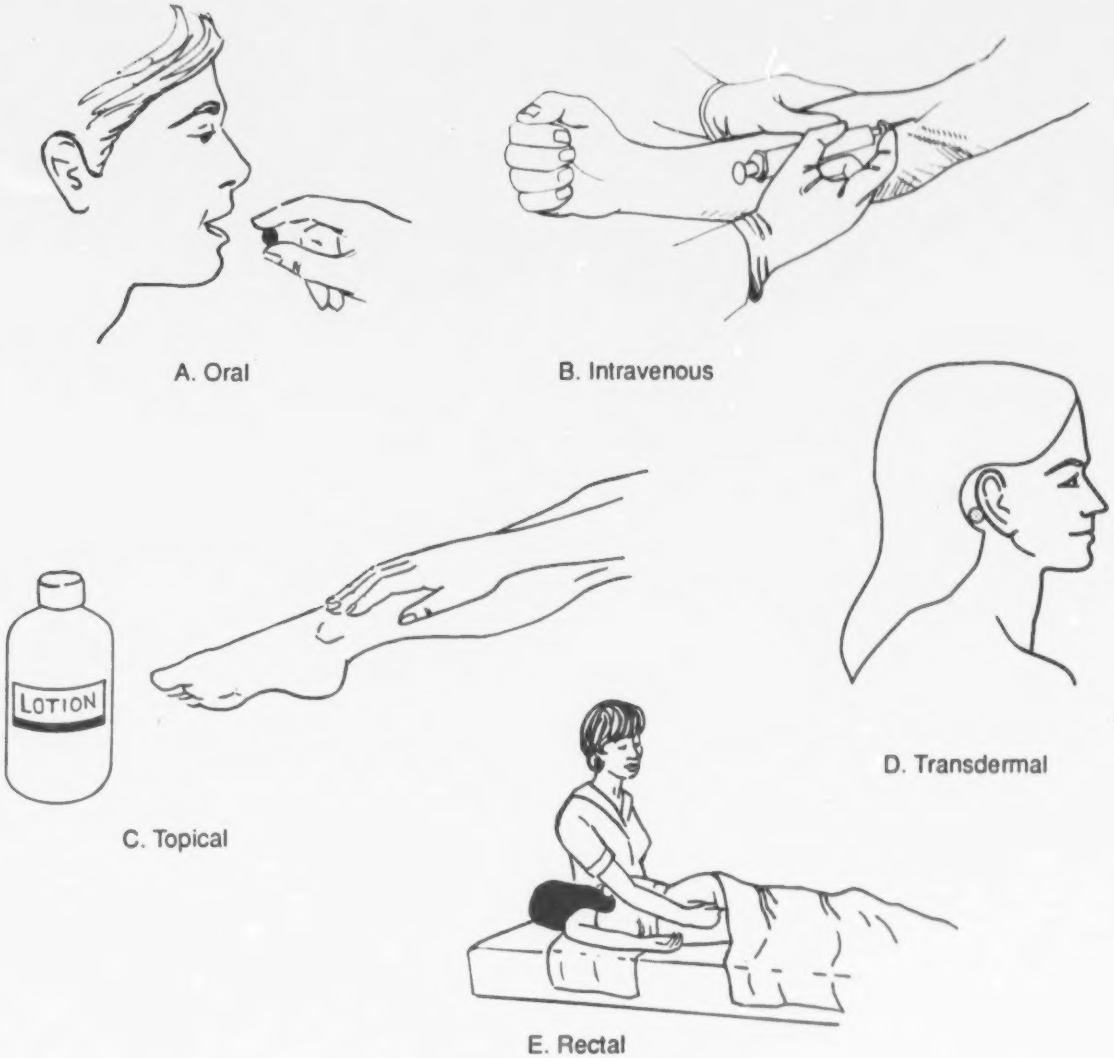
Intraosseous administration is the injection of medication into the bone marrow. This method is used in pediatrics, chemotherapy, and in emergency situations for treatment of shock. An example is the long-term chemotherapy administered to geriatric patients.

Intrathecal or *intraspinal administration* is an injection directly into the cerebrospinal fluid. The main purpose of this route is to ensure that the drug enters the central nervous system (brain and spinal cord). Many drugs do not reach these areas when given by any other route. This can be a very difficult technique, and great care must be taken when this route is used. Examples of this method are spinal anesthesia for childbirth and some antibiotics for CNS infections.

Subcutaneous administration is injection of a drug under the skin (beneath the cutaneous layers). Many drugs are given by this route to obtain slow, even, and prolonged effects. Sometimes drug pellets can be implanted under the skin for very prolonged effects (up to months). It is important to remember that only nonirritating drugs can be administered subcutaneously; otherwise, skin sloughing may occur. An example of a drug administered through this route is insulin.

Intradermal administration is injection into the skin itself (within cutaneous layers). This is a specialized route of administration used for some diagnostic agents—for example, skin tests for allergies.

Intrapleural administration is injection within the pleural (lung) cavity. Some antitubercular drugs are administered in this way.



A. Oral

B. Intravenous

C. Topical

D. Transdermal

E. Rectal

Fig. 1. Routes of drug administration

Intraperitoneal administration is injection into the peitoneal (abdominal) cavity. Rapid absorption occurs from this large space, and large volumes can be injected. This route is rarely used in people, but is a common route in laboratory animals. Great care must be taken to avoid puncturing the stomach or intestines. An example is peritoneal dialysis in humans.

TOPICAL ADMINISTRATION

Topical administration is used for medications applied to the surface of the skin. Antiseptics, creams, and ointments are generally administered directly to the site of action for a local effect. However, some drugs can be absorbed through the skin, especially if the skin is cut or abraded. Examples are antiseptic cream, first-aid lotions, and hand lotions (see fig. 1C).

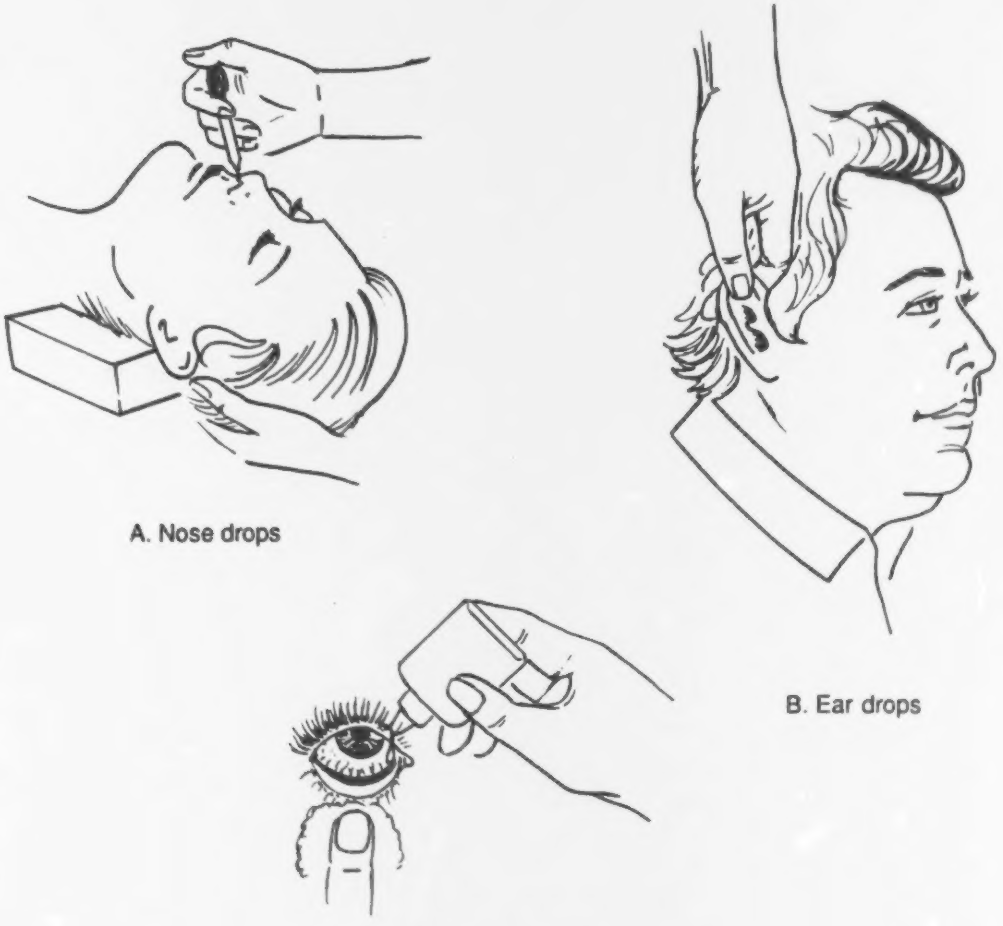
Transdermal administration is accomplished by the use of dermal patches applied to portions of the body. These vary in size and shape. Drugs are delivered at a constant, even rate of flow for hours or sometimes days. The rate of absorption is slower but prolonged. Patches are easy to apply and cause no discomfort. Current treatment utilizes these for heart conditions, motion sickness, nicotine addiction, and hormone therapy for birth control. Examples of dermal patches are the scopolamine patch to overcome motion sickness and nitroglycerine for angina. A patch is shown in figure 1D.

RECTAL ADMINISTRATION

This route involves placing the medication into the lower rectum for absorption into the blood stream. This can be done by means of a suppository or an enema. This route is sometimes useful when a patient is vomiting or unconscious or cannot take anything by mouth for some reason. Absorption is relatively irregular and incomplete, and it is rather inconvenient for the patient. Examples are aspirin suppositories and antiemetic (antivomiting) drugs (see fig. 1E).

APPLICATIONS TO MUCOUS MEMBRANES

Mucous membranes are located in the nose, throat, mouth, respiratory tract, eyes, rectum, and genitourinary tract (urethra and vagina).

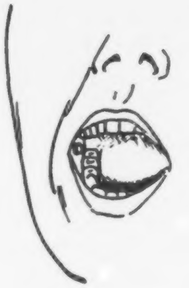


A. Nose drops

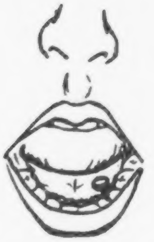
B. Ear drops

C. Eye drops

Fig. 2. Applications to mucous membranes



A. Buccal



B. Sublingual

Fig. 3. Buccal and sublingual administration of drugs

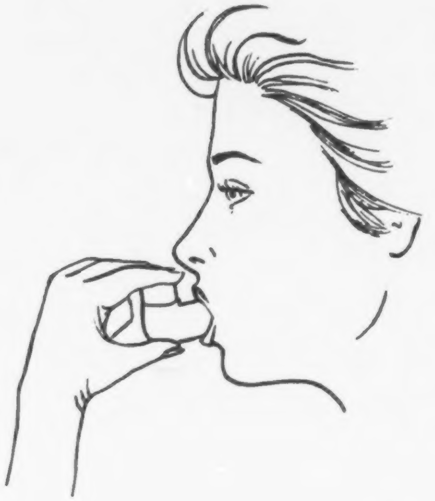


Fig. 4. Inhalation of medication

Drugs to treat these membranes can be painted, swabbed on the surface, instilled, sprayed, or administered by douche, irrigation, or suppository. Examples are drops for the nose, ear, and eye, as shown in figure 2.

SUBLINGUAL AND BUCCAL ADMINISTRATION

Sublingual administration refers to a drug being held under the tongue until it has been dissolved and absorbed. In *buccal administration,* the drug is held in the buccal pouch between the cheek and gum (e.g., cough drops). The physiology of both areas permits rapid absorption. A limited number of drugs are administered in this manner. Nitroglycerine for acute angina is an example of sublingual administration. Both routes are shown in figure 3.

INHALATION

Any medication that is gaseous or volatile, nonirritating to the nasal and respiratory mucosa, and capable of absorption may be administered by inhalation. The entire respiratory tract offers an enormous surface of absorbing tissue. Vary rapid absorption can take place, and it is a useful route for some emergency situations. Also in some respiratory disease, the drug goes to the desired site of action immediately. Examples of this method are oxygen, ether, bronchodilators, and corticosteroids. Refer to figure 4.

SUMMARY

The considerations used to determine the best route of administration of a drug are its chemical properties, its physical properties, the site of desired action, the rapidity of response desired, and the patient's general condition. Routes of administration are oral, parenteral, topical, and rectal application; application to mucous membranes; sublingual or buccal administration; and inhalation.

11

Cardiovascular Drugs

Objectives: After completing this unit, you will be able to—

1. *list the parts of the cardiovascular system;*
2. *discuss the ways by which cardiac drugs can affect the heart;*
3. *describe the role diuretics play in treating hypertension and other cardiovascular disease;*
4. *discuss the other types of drugs used to treat hypertension;*
5. *give examples of drugs used in shock and hypotension;*
6. *name the agents used in vascular disorders other than hypertension; and*
7. *differentiate between coagulants and anticoagulants.*

TERMS AND DEFINITIONS

adrenaline—the major chemical mediator for nerve impulses in the adrenergic nervous system (also called epinephrine)

adrenergic nervous system—a portion of the peripheral nervous system responsible in part for blood pressure control

angina pectoris—chest pain associated with insufficient oxygen supply to the heart muscle

angiotensin—a chemical in the blood that is a very potent constrictor of blood vessels

arrhythmia—abnormal, irregular heartbeat

arteriole—the smallest type of artery as the artery subdivides, immediately preceding the capillaries

artery—a major blood vessel carrying blood away from the heart

bradycardia—slow heart rate (less than 60 beats per minute)

capillary—the smallest blood vessel of the vascular system, connecting the arteriole and the venule

cardiovascular—pertaining to the heart and blood vessels

coagulation—blood clotting

diastole—the relaxation of the heart muscles during its contraction and relaxation cycle

diuretic—a drug that increases urine output

edema—accumulation of excess fluid in the body

extracellular—outside the cell

hypertension—persistent, elevated blood pressure

hypotension—low blood pressure

intracellular—within the cell

lymphatic system—the part of the vascular system composed of lymph, lymph nodes, and lymphatic vessels

renal—pertaining to the kidney

systole—the contraction of the heart muscles during its contraction and relaxation cycle

thrombosis—clot formation within the vascular system

vein—a major blood vessel carrying blood to the heart

venule—a minute vein connecting capillaries with veins

The cardiovascular or circulatory system consists of many different parts of the body. They all work together to maintain normal cellular metabolism by (1) bringing a continual supply of oxygen and nutrients to the cells, (2) removing by-products of metabolism, and (3) maintaining a normal balance between intracellular and extracellular body fluids and chemicals.

The cardiovascular system consists of the heart, arteries, arterioles, capillaries, venules, veins, blood, and the lymphatic system (see fig. 1). Circulatory failure anywhere in the system, if untreated, will eventually cause death. Sometimes, even when death is prevented, irreversible changes occur before treatment.

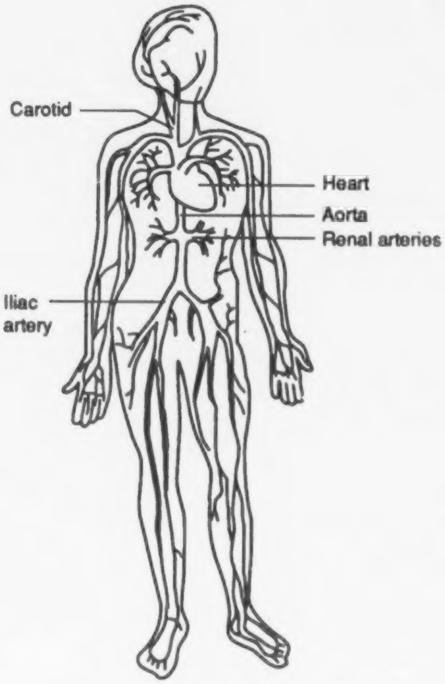


Fig. 1. The heart and arteries

Because the cardiovascular system consists of so many structures, many different kinds of drugs can exert action somewhere in the system. Cardiac drugs, renal drugs, antihypertensive drugs, drugs for hypotension and shock, drugs for vascular disorders, coagulants, and anticoagulants all act on some part of the cardiovascular system.

CARDIAC DRUGS

Cardiac drugs directly affect the heart. They are usually used to alter heart rate, rhythm, or the strength of contractions. The heart normally beats at a rate of about 60 to 100 times per minute. A heart rate of less than 60 beats per minute is referred to as ***bradycardia***, and a rate greater than 100 beats per minute is referred to as ***tachycardia***. Some cardiac drugs cause the heart to beat faster, some cause the heart to beat slower, and some have no effect on the heart rate. Besides rate, drugs may affect heart rhythm and the strength of heart contractions. Some of these effects may be primary effects, and others may be secondary.

Heart rate. Propranolol (Inderal) is very often used to slow down a heart that is beating too fast. Propanolol is one of the group of drugs called the beta-adrenergic blocking agents. The beta-adrenergic receptors in the heart itself, when stimulated by normally circulating chemicals (e.g., adrenaline), react by increasing the heart rate. Blocking these receptors with a drug such as propranolol prevents this normal stimulation, and the heart slows down. If the heart rate is too slow, it can be increased by giving a drug such as epinephrine.

Heart rhythm. In addition to beating at a certain rate, the heart normally beats in a very rhythmic manner. If this regular rhythm is disrupted, an ***arrhythmia*** is said to be present. There are many different types of arrhythmia (e.g., extra contractions, heart blocks). Agents (drugs) used to restore normal rhythm are referred to as the antiarrhythmics. Examples of antiarrhythmics are quinidine (Quinidex, Cardioquin), procainamide (Pronestyl), and lidocaine (Xylocaine). These drugs act in a somewhat similar manner to restore normal rhythm and circulation by decreasing the heart's excitability and contractility. They are potentially very dangerous agents if used incorrectly, but are useful when used in the proper manner for therapy. Lidocaine is somewhat unique in that it was originally designed as a local anesthetic. However, it was found to be a very effective agent, particularly in some emergency situations, in restoring normal heart rhythm. Because it can only be administered intravenously, it is used only for inpatients.

Strength of heart contractions. One very common heart condition is cardiac insufficiency or congestive heart failure. The heart is not able to pump enough blood to meet the body's demands, and the blood tends to back up in the veins, which gives rise to congestion. This congestion can also cause *edema* because of the fluid retention in the body.

The major drugs used in this condition of the heart are digitalis and the so-called digitalis alkaloids from foxglove plants (see fig. 2). Digitalis has three immediate effects on the cardiovascular system. It strengthens heart contractions, increasing the flow of blood throughout the body. It also slows the heart rate so that increased amounts of venous blood return to the heart. Digitalis also lowers the increased venous pressure associated with the insufficiency. All of these actions serve to improve circulation throughout the body.

The pharmacy worker should be familiar with two purified digitalis alkaloids, digoxin and digitoxin. Of these two drugs, digoxin is used preferentially in most patients. Both of these alkaloids are marketed under a variety of trade names (e.g., digoxin as Lanoxin; digitoxin as Purodigin and Crystodigin). It is very important to note that digoxin and digitoxin are not the same drug.

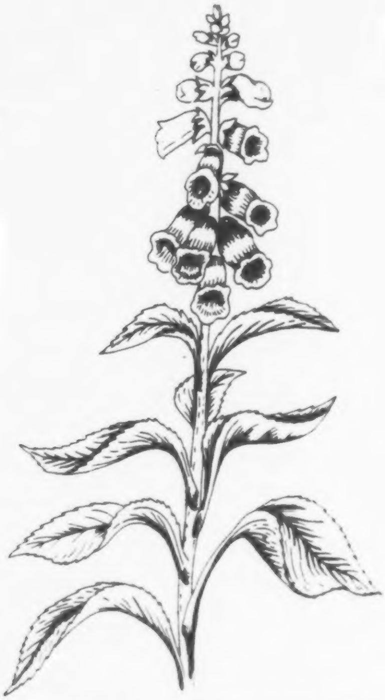


Fig. 2. Foxglove (Digitalis purpurea), *from which the drug digitalis is obtained*

RENAL DRUGS

Renal refers to the kidneys. Although the kidneys are not part of the cardiovascular system, they are crucial to its proper functioning. The kidneys play an essential role in maintaining the normal balance between intracellular and extracellular body flulids. Edema is one of the symptoms and possible conplications of congestive heart failure and other cardiovascular diseases. Renal drugs help rid the body of excess fluid. Renal drugs are also useful in the treatment of hypertension.

Diuretic drugs promote the excretion of urine. They act on the kidneys to promote sodium and water excretion, which eliminates the extracellular fluid causing edema. The many diuretics on the market act basically in a similar manner. They differ in potency and precise site of action within the kidney itself. Representative diuretics are listed in the next section.

ANTIHYPERTENSIVES

The arteries and arterioles are composed of muscular coats that enable them to contract. Vascular contraction and relaxation come into play during the heart's contraction (*systole*) and relaxation (*diastole*). When the heart contracts, blood flows into the arteries. The arteries then expand to allow for the increased volume of blood coming from the heart. The arteries then contract to force the blood further through the entire system. Blood pressure is the tension or force that the blood is exerting against the walls of the blood vessels. As the heart and arterioles are contracting and relaxing, two pressure readings can be obtained, systolic and diastolic. When blood-pressure readings are recorded, both systolic and diastolic pressures are noted as follows:

120 (systolic)
80 (diastolic)

The units are expressed as millimeters of mercury (mm Hg).

Hypertension is a condition of sustained abnormally high blood pressure. It may involve systolic or diastolic pressure or both. Systolic hypertension may be caused by such conditions as increased pumping of the heart or hardening of the arteries near the heart. Diastolic hypertension (most common) generally results from a constriction of the arterioles from any number of possible reasons. There are two types of diastolic hypertension, essential (primary) and secondary. Essential hypertension has no evident cause. Secondary hypertension has its origins in some other disorder (renal, endocrine, etc.). Approximately 90 to 95 percent of all hypertensive patients have essential hypertension.

Altlhough essential hypertension is not curable, antihypertensive drugs are used to control the disease. These drugs are intended to bring the high pressures back to within normal limits to prevent the complications associated with untreated hypertension (strokes, blindness, heart attacks, and kidney failure). The type of antihypertensive action depends on the drug used. There are four general types of pharmacologic action:

- Action directly on the blood vessel walls to relax the muscles will decrease the pressure exerted on them.
- Action on the part of the brain that is the nerve center for the cardiovascular system can block nerve impulses coming from it that cause increased tension in the walls of the blood vessels.
- Action to inhibit certain enzymes in the blood and other tissues will prevent the formation of chemicals that cause pressure increases in the blood vessels (particularly arterioles).
- Action to decrease the force of the heart's contractions will lower pressure in the system.

Many drugs currently available are useful in treating hypertension by one or more of the actions described above. Sometimes these drugs are used in combinations to take advantage of the different mechanisms. There are four general drug classes useful in the treatment of hypertension—diuretics, direct-acting vasodilators, indirect-acting vasodilators, and angiotensin converting enzyme inhibitors.

Diuretics. Diuretics act by promoting the excretion of sodium and water and are used to treat edema. These drugs are also useful in the treatment of hypertension because they lower the blood pressure somewhat. The exact mechanism of this antihypertensive effect is unclear. Diuretics are no longer used as a first choice in treating hypertension because of their profound effect on electrolyte balance, especially in the depletion of potassium. These agents are added later to the drug regimen. The diuretic dyazide is a combination of potassium-sparing and potassium-depleting agents. The most commonly used diuretics are furosemide (Laxis), bumetamide (Bumex), and indapamide (Lozol).

Direct-acting vasodilators. These drugs act directly on the blood vessels to cause them to relax and dilate, thereby causing the blood pressure to drop. These antihypertensives have a number of undesirable side effects, however. They should always be used in combination with other drugs to reduce these side effects to allow for the lowest possible dose. Side effects include headaches, dizziness, drowsiness, loss of apppetite, nausea and vomiting, diarrhea, and heart palpitations (rapid heartbeat of which the patient is aware). Examples of direct-acting vasodilators include hydralazine (Apresoline), minoxidil (Loniten), and prazosin (Minipress). Prazosin is also an adrenergic drug.

Drugs acting on the adrenergic nervous system. These drugs act by selectively affecting the central and peripheral nervous systems. The nerves involved are those responsible for controlling blood pressure. Since these drugs indirectly cause vasodilation, they are also called indirect-acting vasodilators. Remember that the direct-acting vasodilators act directly on the vascular muscle, while the indirect-acting vasodilators act by interfering with nerve messages to the vascular muscle. Examples of antihypertensive drugs that act on the brain to cause vasodilation are methyldopa (Aldomet) and clonidine (Catapres). Some antihypertensive drugs that act on the peripheral nervous system by interfering with nerve-impulse transmission at or very near the muscle of the blood vessels are propranolol (Inderal), nadolol (Corgard), metoprolol (Lopressor), prazosin (Minipress)—also a direct-acting vasodilator—guanethidine (Ismelin) and reserpine (many trade names). Reserpine is derived from the snakeroot plant (*Rauwolfia serpentina*) and has been used in India for 35 centuries. A snakeroot plant is shown in figure 3.

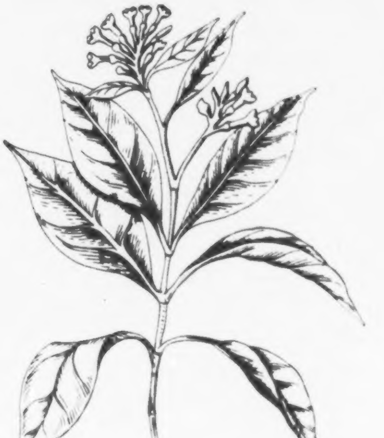


Fig. 3. Snakeroot (Rauwolfia serpentina), *the plant from which the drug reserpine is obtained*

Cardiac drugs. Calcium channel blockers, used for the prevention of angina and hypertension, are thought to work by inhibiting the influx of calcium ions through the cell membranes of the smooth muscle.

Angiotensin-converting enzyme inhibitors (ACE inhibitors) are a relatively new but rapidly growing class of antihypertensives. The newest agents in this class of drugs are Monopril and Accupril.

Other agents are used as antihypertensives, but only for medical emergencies, usually in hospital emergency rooms.

DRUGS FOR SHOCK AND HYPOTENSION

Shock and hypotension are both characterized by decreased blood pressure. *Hypotension* is abnormally low blood pressure over a period of time. It may or may not require treatment, depending on the patient's clinical status. *Shock* is low blood pressure as a result of profound circulatory collapse, and it requires immediate emergency attention. Drugs used to elevate the blood pressure usually constrict blood vessels and stimulate the heart to pump blood faster. Examples of drugs in this group are epinephrine (Adrenalin), norepinephrine (Levophed), isoproterenol (Isuprel), metaraminol (Aramine), methoxamine (Vasoxyl), and dopamine (Intropin).

OTHER VASCULAR DISORDER DRUGS

Other vascular disorders besides those already mentioned are treated by vasodilators. Pharmacologically, these vasodilators and those used as antihypertensives are very similar. All drugs used to lower blood pressure do so by vasodilation. However, some vasodilators used in other vascular disorders are not used as antihypertensives because of their side effects and vice versa.

Agents in this group include those useful in angina pectoris (nitroglycerin and other nitrates), dipyridamole (Persantine), and hydralazine (Apresoline).

Other vasodilators are used in other peripheral vascular disorders, such as spastic conditions of the arteries, chronic closure of the arteries, and frostbite. Examples of these vasodilators are nicotinic acid or niacin, isoxsuprine (Vasodilan), and papaverine (Pavabid, Cerespan).

COAGULANTS AND ANTICOAGULANTS

Coagulation is the process by which blood clots form. The process of coagulation is biochemically very complex, but it involves reactions between many different plasma proteins (e.g., prothrombin, fibrinogen). These substances, as well as substances that prevent coagulation within the vascular system, are normally present in the blood. Occasionally, clots occur in the vascular system, which can be medically very dangerous to the patient. This condition is called ***thrombosis.*** The clot (thrombus) may naturally disintegrate, and pieces can lodge in the heart or the brain, blocking circulation.

Anticoaglulants are administered to prevent clotting within the vascular system. They are often used in patients who are prone to thrombosis (e.g., some heart paients). Examples of anticoagulants include heparin, coumarin (Dicumarol), and warfarin (Coumadin). Heparin, the drug of choice for rapid anticoagulation, can only be used parenterally, so it is usually used only for inpatients. Coumarin and warfarin are orally administered agents and can be used on a more chronic basis by outpatients. Coumarin is useful but loaded with side effects.

The most useful drugs that produce anticoagulant effects are the antiplatelet aggregation agents. These drugs prevent platelets from adhering to each other. Dipyridamole (Persantine) is the original antiplatelet aggregation agent. The newest preparation is ticlopidine (Ticlio).

Coagulants are agents used to promote the clotting mechanism in patients prone to hemorrhage or in patients who have taken too much anticoagulant. Their use is generally to restore the normal body defense mechanisms against hemorrhage rather than to produce active clotting. Coagulants useful in medicine are vitamin K (clotting vitamin), thrombin itself, and many blood and plasma fractions.

SUMMARY

Cardiac drugs directly affect the heart. They alter the heart rate, heart rhythm, and the strength of heart contractions. Medications for hypertension (high blood pressure) include diuretics, direct-acting vasodilators, indirect-acting vasodilators, and angiotinsin-converting enzyme inhibitors. Hypotension (low blood pressure) and shock require medications to elevate blood pressure. Coagulants are used to aid the process of coagulation by which blood clots form. Anticoagulants are administered to prevent clotting within the vascular system.

12

Gastrointestinal Drugs

Objectives: After completing this unit, you will be able to—

1. *list the parts of the gastrointestinal system;*
2. *describe the role that digestants play in the treatment of gastrointestinal disorders;*
3. *discuss the role of anticholinergics, antispasmodics, and histamine-2 receptor blockers in treating gastrointestinal disorders, particularly peptic ulcers;*
4. *compare emetics and antiemetics for treatment of gastrointestinal disorders; and*
5. *give examples of anthelmintics used in the treatment of gastrointestinal disorders.*

TERMS AND DEFINITIONS

acetylcholine—chemical mediator in the cholinergic nervous system
achlorhydria—lack of hydrochloric acid
anthelmintic—agent used to rid the body of parasitic worms (helminths)
anticholinergic—blocker of acetylcholine-mediated nerve impulse propagation
antiemetic—agent that reduces vomiting (emesis)
antispasmodic—agent that reduces spasms, particularly the smooth muscle of the gastrointestinal tract
digestant—agent that promotes or aids in the digestive process
emetic—agent that induces vomiting (emesis)
gastrointestinal system—system composed of the mouth, salivary glands, esophagus, stomach, intestines, liver, gall bladder, and pancreas
histamine-2 receptor—receptor for histamine that mediates the secretion of hydrochloric acid in the stomach
hypochlorhydria—low amount of hydrochloric acid

The gastrointestinal (GI) system is composed of the mouth and salivary glands, esophagus, stomach, small intestine, large intestine, liver, gall bladder, and pancreas. These parts are shown in figure 1. The GI system functions primarily to act on food both mechanically and chemically. The mechanical action involves the actions of the GI muscles to propel food materials through the entire system from the mouth to the anus. The chemical action involves the GI enzymes responsible for chemically converting food into simpler chemical compounds that can be absorbed into the bloodstream to provide nutrition and energy for all the body tissues.

Many of the drugs used on the GI system can be purchased over-the-counter. For a discussion of them, refer to the later unit on nonprescription antacids.

DIGESTANTS

Digestants are drugs that promote or aid the digestive processes in the GI tract. They may be used as supplements to normal digestion, or they may be used as replacements in cases where the normal digestive substances are absent.

Hydrochloric acid. Hydrochloric acid (HCl), secreted by special cells in the stomach, is essential to the normal digestive processes. Deficiencies in HCl (*hypochlorhydria*) or total absence of HCl are not uncommon problems. HCl preparations are designed to increase the acidity of the GI tract, thereby aiding digestion. HCl can be supplied in many forms—tablets, capsules, or as dilute HCl liquid itself. The tablets and capsules release free HCl in the stomach. Patients should be warned not to chew the tablets or capsules, as the acid released

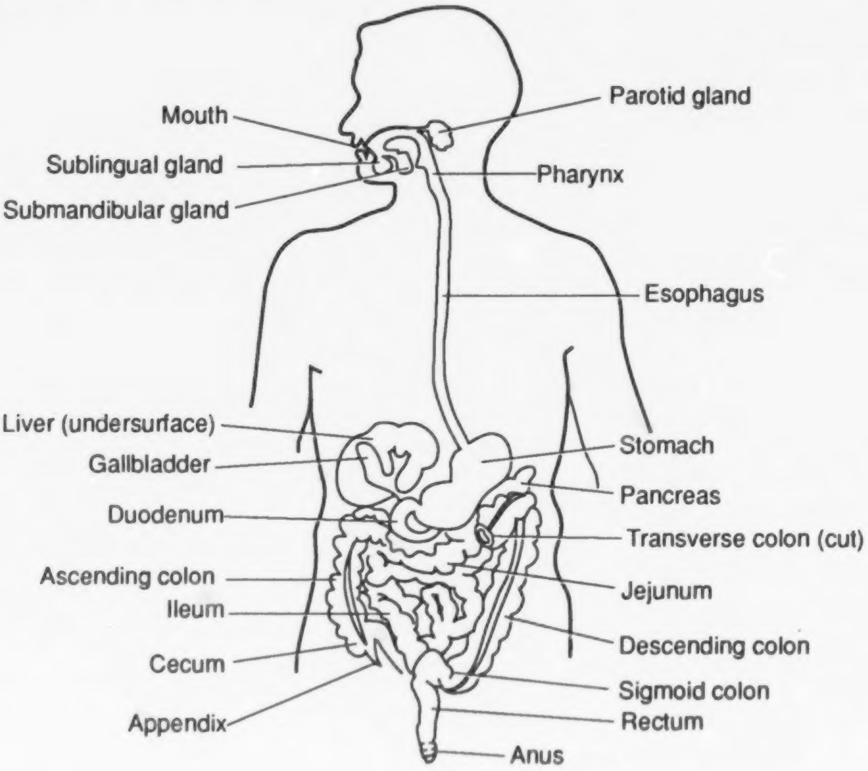

Mouth
Sublingual gland
Submandibular gland
Parotid gland
Pharynx
Esophagus
Liver (undersurface)
Gallbladder
Duodenum
Ascending colon
Ileum
Cecum
Appendix
Stomach
Pancreas
Transverse colon (cut)
Jejunum
Descending colon
Sigmoid colon
Rectum
Anus

Fig. 1. The digestive system

may damage the mouth and teeth. Examples of HCl dosage forms include betaine HCl (Normacid) and glutamic acid HCl (Acidulin). Dilute HCl liquid preparations are generally further diluted by the patient before ingestion.

Bile, bile acids, and bile salts. Bile coming from the liver has a variety of functions. The most important ones are in the digestion and absorption of fats and fat-soluble vitamins. Bile salts aid in the emulsification and absorption of fats. Bile and bile salts also play a part in activating some of the digestive enzymes. Examples of these preparations include dehydrocholic acid (Decholin) and desoxycholic acid.

Digestive enzymes. Normal digestive enzymes are also essential for the proper digestion of food in the GI tract. Some of the more common digestive enzymes include pepsin and trypsin. Some commercially available enzymes, such as pancreatin (Cotazym, Ilozyme, Viokase), are obtained from animals. Others are diastase (Taka-Diastase) and papain (Digolase, Panafil).

ANTICHOLINERGICS AND HISTAMINE RECEPTOR ANTAGONISTS

Peptic ulcer disease is a very common GI problem. Antacids are the mainstay of ulcer therapy, but a number of prescription drugs are also useful in this condition.

Anticholinergics. The automatic nervous system (part of the peripheral nervous system) consists of the adrenergic and the cholinergic systems. You learned in unit 11, Cardiovascular Drugs, that the major chemical mediator for nerve impulses in the adrenergic system is epinephrine (adrenaline). In the cholinergic system, the major chemical mediator is acetylcholine. The cholinergic nervous system is responsible for many of the functions of the GI tract (e.g., salivation, GI secretions, motility). By blocking cholinergic responses, the anticholinergic drugs are useful in some conditions (e.g., peptic ulcer) where there may be an excessive amount of cholinergic activity (increased acid secretion). Some anticholinergics are atropine, methantheline (Banthine), propantheline (Pro-Banthine), isopropamide iodide (Darbid), glycopyrrolate (Robinul), oxyphenonium (Antrenyl), and dicyclomine (Beutyl). Acetylcholine mediates a large number of other bodily functions in addition to GI functions. Side effects with these anticholinergics (e.g., dilated pupils, blurred vision, dry mouth, urinary retention, increased blood pressure, palpitations) are common.

Some weaker anticholinergics are used in GI conditions for their effects as antispasmodics rather than as secretion blockers. Their side effects, however, are similar to the other anticholinergics. Example of these drugs include methixene (Trest), dicyclomine (Bentyl), and adiphenine (Trasentine).

Histamine receptor blockers. Histamine is also a chemical mediator for the secretion of HCl in the stomach. Antihistamines used for colds and minor allergies have no effect on the GI function of histamine because different histamine receptors are involved. A class of drugs called histamine-2 receptor blockers has been designed to block the GI secretory effects of histamine. These block only the histamine receptor (histamine-2 receptor) responsible for gastric secretion of HCl. The original drug was cimetidine (Tagamet). It is used for hypersecretory conditions such as peptic ulcer. It can be used in conjunction with antacids. Because of its many side effects and interactions with other drugs, its use has declined. Ranitidine (Zantec) is widely used. Similar drugs are famotidine (Pepcio) and nizatidine (Axio).

EMETICS AND ANTIEMETICS

Emetics are frequently used to induce vomiting in emergency cases of poisoning. Gastric lavage (pumping the stomach) is probably most widely used, but sometimes an emetic may be preferred. Three types of emetics generally are used today. Of these, only apomorphine is a prescription drug.

Saline solution. Saltwater, prepared with about three heaping teaspoonfuls of table salt in a glass of hot water, will usually induce vomiting.

Ipecac. This drug, usually available as a syrup, acts both centrally and peripherally to induce vomiting. Its usefulness is limited, because it may take 30 to 45 minutes to exert its effect. It is most often used in pediatrics. Ipecac syrup should be kept in households with small children and used, on the advice of a physician only, in cases of suspected or actual poisoning.

Apomorphine. This is a derivative of morphine that produces nausea and vomiting by direct stimulation of the vomiting center in the brain. It can act very rapidly, but it must be given parenterally to be most effective.

Antiemetics. *Antiemetics,* also called *antinauseants,* are used to stop nausea and vomiting. Nausea and vomiting can have many causes, such as unpleasant odors, sights, or experiences, emotional upset, motion sickness, gastric upset, pregnancy, and others. Most of the drugs used to prevent nausea and vomiting act on the specific areas in the brain where nerve impulses activating nausea and vomiting originate. Some antihistamines are particularly useful in treating motion sickness (e.g., air sickness and sea sickness). They include cyclizine (Marezine), trimethobenzamide (Tigan), dimenhydrinate (Dramamine), meclizine (Antivert), and promethazine (Phenergan) in tablets and suppositories. Some of these may be purchased over-the-counter.

Transderm-scop is also used for motion sickness. It is available as a scopolamine-containing patch, worn behind the ear for up to three days, to control the nausea related to vertigo and motion sickness.

ANTIDIARRHEALS

Antidiarrheals are medications used to control excessive, watery bowel movements. Most of the antidiarrheals are covered in a later unit, but a few are available only on prescription. Diphenoxylate contained in Lomotil is a synthetic opium derivative that has an antidiarrheal effect, without any of the other opiate actions (e.g., analgesia, addiction). Loperamide (Imodium) is another synthetic antidiarrheic that is used to control protracted diarrhea by slowing down the peristalsis (contraction) of the intestinal muscles.

ANTHELMINTICS

Anthelmintics are used to rid the body of parasitic worms (helminths). Because many anthelmintics can be toxic to humans as well as to worms, they are available primarily by prescription. Some examples include mebendazole (Vermox) and pyrvinium pamoate (Povan). Pin-X and Antiminth are available over-the-counter.

SUMMARY

The gastrointestinal system is composed of the mouth and salivary glands, esophagus, stomach, small intestine, large intestine, liver, gall bladder, and pancreas. It acts on food mechanically and chemically. Digestants promote the digestive processes. The cholinergic nervous system is responsible for many functions of the GI tract. Anticholinergic drugs are used to block the acetylcholine-mediated nerve-impulse propagation of this system. Histamine-2 receptor blocker is also used to block GI secretory effects. Emetics are used to induce vomiting. Antiemetics are used to stop nausea and vomiting. Some antidiarrheals require a prescription. Anthelmintics are used to rid the body of parasitic worms.

13

Respiratory Drugs

Objectives: After completing this unit, you will be able to—

1. *list the parts of the respiratory system;*
2. *describe the functions of the parts of the respiratory system;*
3. *give examples of types of drugs that are used as bronchodilators; and*
4. *discuss the preventive management of asthma with drugs.*

TERMS AND DEFINITIONS

alveoli—sacs at the end of the bronchioles where gaseous exchange in the lungs takes place
antitussive—anticough drug
bronchi—large air passageways from the trachea to the lungs
bronchial tree—the bronchi plus the bronchioles and trachea
bronchiole—very small air passageway branching off the bronchi
bronchodilation—opening up of the breathing tubes (bronchi and bronchioles)
larynx—voice box
medulla oblongata—portion of the brain where the respiratory centers are located
nasopharynx—nose, throat, and larynx
pharynx—air passageway between the nasal cavity and larynx
prophylaxis—measures designed to preserve health and prevent the spread of disease
trachea—windpipe

To function properly, all cells require a continuous supply of oxygen and a continuous removal of carbon dioxide. Blood circulating through the lungs picks up oxygen from the air you breathe and gives up carbon dioxide. Blood carried to the tissues gives up oxygen to the cells and picks up carbon dioxide. This continual exchange of gases is known as respiration. Interruption of the cycle for more than a few minutes or a few seconds, in some cases, can cause irreparable damage to tissue and, eventually, death. Irreversible brain damage can happen even when death does not occur.

The major portions of the respiratory system are the nasopharynx (nose, throat, and larynx), bronchial tree (trachea, bronchi, and bronchioles), and the lungs (bronchioles and alveoli). These are shown in figure 1.

The nose serves as a passageway for air going to and from the trachea. It warms and humidifies the air before it goes to the lungs. It also contains the organs of smell. The nose, throat, and larynx, along with the ears and the sinus cavities, are interconnected by several openings. The nasopharynx serves three primary purposes. It transmits air from the nose and mouth to the trachea. It acts as a resonator for the voice. It also provides passage to the esophagus for food and drink. During swallowing, the epiglottis closes to prevent food or drink from going down the trachea.

The bronchial tree is composed of the trachea, bronchi, and bronchioles. The trachea is an air tube, about four to five inches long, leading from the larynx to the bronchi. The two major bronchi branch from the trachea. As they go further into the lungs, they branch again and again into many bronchioles, reaching deep into the lungs. At the ends of the smallest bronchioles in the lungs are the alveoli, where the actual exchange of gases takes place. The lungs are very porous and spongy. They are composed of six to eight million alveoli.

The basic function of respiration (breathing) is to supply oxygen to the body and to rid the

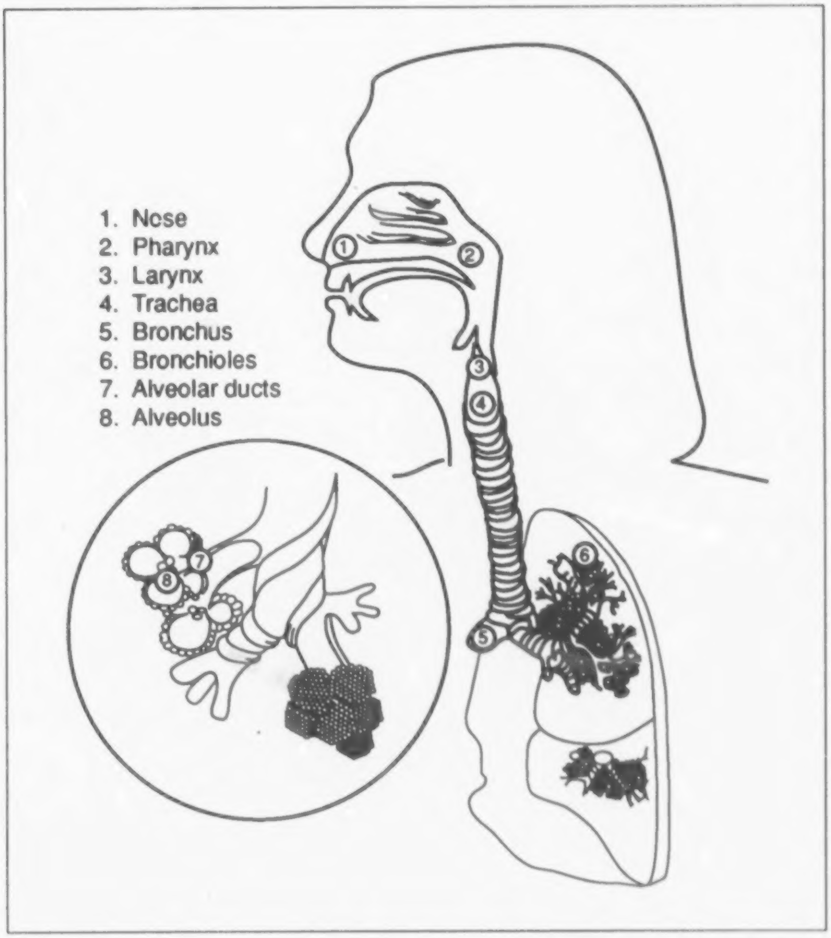


Fig. 1. The respiratory system

body of carbon dioxide. Inspiration, or inhalation, results from contraction of the inspiratory muscle in the chest. Expiration, or exhalation, is due mainly to the elastic recoil of the lungs, which are stretched during inhalation.

The respiratory center in the brain is in the medulla oblongata. Impulses originate in the medulla oblongata, stimulating the muscles that affect respiratory rhythm. The respiratory center is sensitive to many factors. Changes in blood pH, percentage of oxygen and carbon dioxide in the blood, and blood temperature can alter respiratory rate and depth. Many drugs can also affect the respiratory center (e.g., caffeine stimulates it, while morphine depresses it).

ANTITUSSIVES

Coughing is a protective reflex of the respiratory system. Antitussive drugs are used to reduce the activity of this reflex. Most antitussives can be obtained without a prescription. One antitussive should be mentioned here, however, since it is available only by prescription and is very potent. This is hydrocodone, a synthetic narcotic. This agent should not be used indiscriminately, as it is addicting, like other narcotics. It is used only for protracted coughing that is nonproductive.

BRONCHODILATORS

These drugs cause the bronchioles to relax and to expand in diameter (dilate), thus easing breathing. Bronchodilators are used in the treatment of asthma and other respiratory diseases where constriction of the bronchioles limits the amount of air passing through them. They are also of some benefit in spastic conditions of the bronchioles where bronchodilation would help the respiratory processes. The two main types of bronchodilators are adrenergic agents and xanthine derivatives.

Adrenergic agents. Some of these are the same agents discussed previously in unit 11, Cardiovascular Drugs. The adrenergics, as we have seen, have many effects (vasoconstriction, increased blood pressure, tachycardia). However, the effect desired in respiratory therapy is dilation of the bronchioles. Examples of adrenergic bronchodilators are epinephrine, isoproterenol (Isuprel, Medihaler-Iso), ephedrine, metaproterenol (Allupent, Metaprel), and terbutaline (Brethine, Bricanyl). These adrenergic agents are among the most effective drugs in treating allergic bronchospasm.

Xanthine derivatives. The effectiveness of the xanthine derivatives is based on their ability to relax smooth muscles controlling the bronchi and bronchioles. Xanthines that cause bronchodilation are theophylline (Slo-Phyllin, Aerolate), dyphylline (Dilor, Lufyllin), and oxtriphylline (Choledyl). Numerous prescription drug products that combine theophylline derivatives and ephedrine for an additive effect are available.

MISCELLANEOUS AGENTS USED IN RESPIRATORY DISEASE

Corticosteroids. Corticosteroids have proven to be valuable in ending acute asthmatic attacks and in relieving some of the disabling symptoms of chronic bronchial asthma. They should be used very judiciously, however.

Cromolyn sodium. Cromolyn sodium (Intal, Aarane) is used as a prophylactic in the treatment of acute asthma. It prevents attacks before they occur by preventing the release of histamine and other substances that actually cause the symptoms of an acute attack of asthma. This drug's mode of administration is unique in that the patient inhales a dry powder from capsules that are place in a special inhaler. The drug acts locally deep in the lungs.

SUMMARY

The major portions of the respiratory system are the nasopharynx, bronchial tree, and the lungs. The basic function of respiration is to supply oxygen to the body and to rid the body of carbon dioxide. Coughing is a protective reflex of this system. Antitussives reduce the reflex activity. Bronchodilators cause bronchioles to expand in diameter. Adrenergic agents and xanthine are the two main types of dilators. Corticosteroids and cromolyn sodium are also used to treat asthma.

14

Nervous System Drugs

Objectives: After completing this unit, you will be able to—

1. *name the parts of the central nervous system;*
2. *discuss the functions of each of the parts of the central nervous system;*
3. *identify the major classes of drugs that act on the central nervous system; and*
4. *list examples of drugs within the classes of agents that act on the central nervous system.*

TERMS AND DEFINITIONS

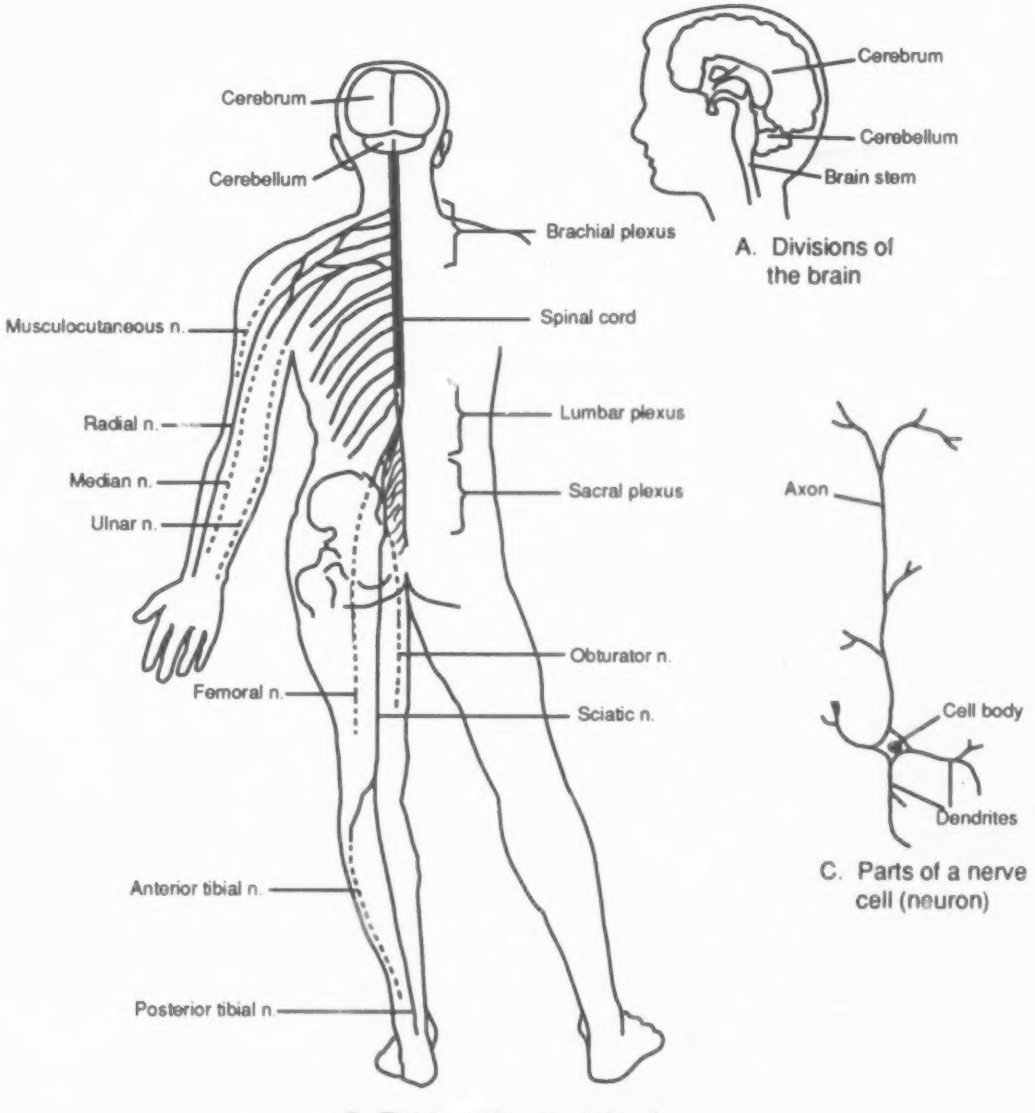
afferent—toward the central nervous system
analgesic—a medicine that relieves pain
anesthesia—partial or total loss of sensation or feeling
anesthetic—drug that produce a partial or total loss of sensation or feeling
axon—nerve fiber; part of the nerve cell that conducts impulses from the cell body
convulsion—a violent, involuntary muscle contraction or a series of such contractions producing jerking movements
dendrite—the branching portion of a neuron that conducts impulses to the cell body
efferent—away from the central nervous system
homeostasis—the tendency to maintain internal stability
hypnotic—a drug that induces sleep
internuncial neuron—also called an interneuron; interconnects other neurons within the central nervous system
mania—an emotional disorder characterized by a state of excitement, hyperactivity, and profuse and rapidly changing ideas
meninges—collectively the three membranes covering the brain
narcolepsy—frequent uncontrollable need for short periods of sleep
neuron—nerve cell
seizure—an attack; the sudden onset of a disease or symptoms, especially epilepsy
synapse—point of contact between an axon and the dendrite of the next neuron

The nervous system is the body's stimulus-response mechanism. It maintains the body's homeostasis by acting to integrate all body functions in response to external and internal stimuli. Two fundamental properties of the nervous system enable it to carry out these homeostatic processes. ***Irritability*** is the ability to respond to stimuli, and ***conductivity*** is the ability to transmit these stimuli by means of nerve impulses.

The nervous system, shown in figure 1, consists of three principal parts—the brain, the spinal cord, and the nerves. The brain and the spinal cord form the central nervous system (CNS). The rest of the system forms the peripheral nervous system (PNS). The autonomic nervous system, which includes the adrenergic and cholinergic divisions, is part of the PNS. The basic structural unit of the entire nervous system is the *neuron* or *nerve cell.*

THE BRAIN

The brain is the part of the central nervous system that is housed in the cranial cavity of the skull. The brain itself consists of three major regions—the cerebrum, the cerebellum, and the brain stem. These parts are shown in figure 1A. The brain is covered by three membranes, collectively called the meninges.


Cerebrum
Cerebellum
Brain stem
Cerebrum
Cerebellum
Brachial plexus
Musculocutaneous n.
Spinal cord
Radial n.
Lumbar plexus
Median n.
Sacral plexus
Ulnar n.
Obturator n.
Femoral n.
Sciatic n.
Anterior tibial n.
Posterior tibial n.
Axon
Cell body
Dendrites

A. Divisions of the brain

C. Parts of a nerve cell (neuron)

B. The central and peripheral nervous systems

Fig. 1. The nervous system

The brain has a number of functions essential to life:

- It is the center for all higher mental processes—thought, reason, judgment, memory, and learning.
- It is the center for all emotions.
- It is the center for all sensations—sight, sound, smell, taste, touch, pain, and movement.
- It is the center of consciousness (awareness).
- It is the regulatory center for all bodily activities.

THE SPINAL CORD

The spinal cord functionally consists of 31 segments, each of which gives rise to a pair of nerve roots, one nerve containing sensory (*afferent*) nerve fibers and the other containing motor or secretory (*efferent*) nerve fibers. Sensory fibers carry nerve impulses to higher centers (spinal cord and brain), and motor fibers carry impulses away from the brain and spinal cord to peripheral sites. The spinal cord is shown in figure 1B.

The spinal cord has two primary functions. It conducts nerve impulses from the periphery to the brain and from the brain to peripheral organs. It also serves as a reflex center for reflexes that do not require the brain. An example is the action of jerking the hand away from a hot object before the brain becomes aware of the stimulus. The spinal cord can be thought of as a conduit for nerve fibers between the brain and peripheral organs.

THE NEURONS

A ***neuron*** is a single nerve cell. It has three primary parts—the cell body, the axon (nerve fiber), and the dendrites, as shown in figure 1C. Impulses pass through the dendrite to the cell body, which then sends the impulses through the axon. The impulses then stimulate the dendrite of the next neuron, and so on. The point of contact between the axon and the dendrite is called a synapse. There are three different types of neurons, which are classified according to function.

Motor (efferent) neurons. The axons of motor neurons end in muscles or organs. These neurons transmit impulses away from the higher centers in the CNS and toward peripheral sites.

Sensory (afferent) neurons. These neurons transmit impulses from the periphery to the higher centers in the CNS.

Internuncial neurons (interneurons). These neurons interconnect with other neurons within the CNS.

All of the above structures and functional units can be affected by drugs. As with cardiovascular drugs, some drugs act on very specific parts of the nervous system, while others have a wider effect on the system. The following discussion mainly concerns drugs affecting the central nervous system.

CENTRAL NERVOUS SYSTEM STIMULANTS

Three main groups of drugs act to stimulate the central nervous system—cerebral stimulants, convulsant stimulants, and antidepressants.

Cerebral stimulants Cerebral stimulants are used to relieve fatigue, elevate mood, and prevent sleep. Drugs in this class can increase the brain's functional activity, but only up to a limited point. *Caffeine*, the principal xanthine in coffee, tea, and cocoa, is a cerebral stimulant. It can be used therapeutically as a mild stimulant and is used in combination with some analgesic drugs (e.g., aspirin) for headache relief.

Amphetamines are a group of closely related cerebral stimulants that are much more potent than caffeine. The amphetamines are used therapeutically to treat narcolepsy and as short-term appetite suppressants in obesity. Interestingly, they also work as agents to calm some hyperactive children so that they can concentrate better. Excessive use of these agents may cause irritability, sleeplessness, and dizziness. The two main amphetamines in use today are amphetamine sulfate (Benzedrine) and dextroamphetamine sulfate (Dexedrine).

A problem associated with amphetamines is abuse of the drug. The sense of well-being it produces, plus the psychological dependence that develops, can lead to serious misuse.

Methylphenidate hydrochloride (Ritalin) is a cerebral stimulant whose potency lies somewhere between caffeine and the amphetamines. It is often used in hyperactive children. It does not appreciably depress the appetite. Cerebral stimulants that are used primarily for their appetite suppression include diethylpropion hydrochloride (Tenuate, Tepanil), phendimetrazine bitartrate (Bacarate, Plegine), phentermin (Ionamin), and phenmetrazine hydrochloride (Preludin).

Convulsant stimulants. Drugs of this type generally act on the respiratory center of the medulla oblongata (a part of the brain stem) and produce an increased rate and depth of breathing. These drugs also can cause convulsions at doses that are similar to or only slightly higher than those required for respiratory stimulation. For this reason, they are rarely used today as respiratory stimulants. Examples of these agents include nikethamide (Coramine) and pentylenetetrazol (Metrazol).

Antidepressants. The cerebral stimulants are not used as antidepressants because of numerous unwanted and sometimes dangerous side effects. The antidepressants are of two general types, the monoamine oxidase inhibitors and the dibenzazepines (mostly tricyclic antidepressants).

Some mental depression is thought to be associated with a change in the amount of some chemicals in the brain. These normally present chemicals are inactivated in part by an enzyme called monoamine oxidase. Monoamine oxidase inhibitors inhibit this enzyme. The brain levels of the chemicals then increase, theoretically relieving depression.

A very serious drug-food interaction can occur with these agents. Certain complicated enzyme interactions can cause severe hypertensive crisis and even strokes. Patients receiving these drugs should not ingest foods that contain tryptophane or tyramine (e.g., broad beans, certain cheeses, pickled herring, beer, and some wines).

Examples of monoamine oxidase inhibitors include isocarboxazid (Marplan), phenelzine (Nardil), and tranylcypromine (Parnate). These agents have a very limited therapeutic usefulness.

The dibenzazepines also increase the levels of some chemicals in the brain but by a different mechanism than the monoamine oxidase inhibitors. These agents are very widely used antidepressants. The drug-food interaction mentioned above for the monoamine oxidase inhibitors is not seen with the dibenzazepine antidepressants. Included in this group are doxepin (Sinequan), imipramine (Tofranil, SK-Parmine), amitriptyline (Elavil), desipramine (Norpramin, Pertofrane), nortriptyline (Aventyl), and maprotiline (Ludiomil). While safer than the monoamine oxidase inhibitors, these agents should still be used cautiously.

CENTRAL NERVOUS SYSTEM DEPRESSANTS

These agents all act to depress parts or all of the central nervous system. Some are referred to as selective depressants, because they act on only a part of the central nervous system.

Anticonvulsants. *Seizures* are violent, involuntary contractions or a series of contractions of voluntary muscles. This type of seizure is called a *convulsion*. A seizure can also be a passing clouding of the consciousness not accompanied by convulsion (e.g., petit mal epilepsy). Seizures can be caused by brain tumors, scar tissue growth following injury to the central nervous system, or presence of toxins, or they may have no apparent cause (e.g., epilepsy in some of its forms). Knowing the type of seizure in a patient is important, because some respond rather specifically to certain anticonvulsant drugs.

The major anticonvulsants include phenytoin (Dilantin), mephenytoin (Mesantoin), phenobarbital (Solfoton), primidone (Mysoline), mephobartital (Mebaral), diazepam (Valium), phensuximide (Milontin), methsuximide (Celontin), ethosuximide (Zarontin), trimethadione (Tridione), clonazepam (Clonopin), carbamazepine (Tegretol), and valproic acid (Depakene).

Antiparkinson agents. Parkinsonism (Parkinson's disease) is a fairly common disease characterized by chronic, progressive muscle dysfunction. It is usually seen as persistent tremors and muscle rigidity. Very often, the muscle activity is accompanied by salivation and sweating. The drug of choice for this disease is L-dopa or levodopa (Larodopa). L-dopa is not to be confused with the antihypertensive methyldopa.

Other drugs useful in parkinsonism include amantadine (Symmetrel), atropine and its many derivatives, benztropine (Cogentin), trihexyphenidyl (Artane), procyclidine (Kemadrine), cycrimine (Pagitane), and biperiden (Akineton).

Sedative-hypnotics. Depending on the dose employed, these drugs can be either sedatives or hypnotics. *Hypnotics* are sleep-producing drugs and differ from the sedatives only in degree. A *sedative* is given for a calming, quieting effect in a dose lower than that required for a hypnotic effect. Today the sedatives have been mostly replaced by the antianxiety drugs (tranquilizers). These agents are still used to some extent as hypnotics, however. They are what are popularly called sleeping pills. All of these drugs can lead to a significant drug dependence; hence, they are of limited usefulness.

Barbiturates and nonbarbiturates are the two main classes of the sedative-hypnotics. Examples of the barbiturates include amobarbital (Amytal), sodium butabarbital (Butisol), sodium pentobarbital (Nembutol), and secobarbital (Seconal). Examples of the nonbarbiturates include glutethimide (Doriden), methprylon (Noludar), chloral hydrate (Noctec, Somnos), paraldehyde, and methaqualone (Quaalude, Sopor).

There is one other drug that is used only as a hypnotic and never as a sedative. It is chemically very similar to Librium and Valium. This drug is flurazepam (Dalmane).

Antianxiety agents (tranquilizers). The antianxiety agents comprise a large group of drugs. They are used to counter anxiety or anxiety associated with other body complaints. They are often used to help control emotional disturbances caused by environmental stresses. They should only be used for a short period of time, however. All of the drugs in this class have potential for habituation and physical dependence. Many of them also have a muscle-relaxing and an anticonvulsant action, as well. Representative tranquilizers are chlordiazepoxide (Librium), diazepam (Valium), oxazepam (Serax), meprobamate (Miltown, Equanil), and hydroxyzine (Atarax, Vistaril).

Antipsychotic agents. The ***antipsychotic agents*** are drugs that produce a detached sense of calmness, usually without significant depression of other mental facilities. They are probably best known for their use in the treatment of mental and emotional disorders, but they do have other limited uses. Antipsychotics can reverse the disordered thought processes in psychotic patients. They can have serious side effects, however. These side effects are similar to the symptoms of parkinsonism. Examples of these drugs are chlorpromazine (Thorazine), fluphenazine (Prolixin), thioridazine (Mellaril), and haloperidol (Haldol).

Narcotic and nonnarcotic analgesics. ***Analgesics*** are drugs used to relieve pain. There are three classes of analgesics. ***Narcotic analgesics*** are the most potent of these types of drugs, providing maximum pain relief. They are addicting, and tolerance, habituation, and physical dependence all may develop. They cause significant side effects (e.g., constipation, nausea and vomiting, respiratory depression), and produce sedation. The naturally occurring opium alkaloids, morphine and codeine, are analgesics made from certain types of poppy. Figure 2 shows the poppy (***Papaver somniferum***) from which opium is extracted. Examples of synthetic narcotic analgesics include meperidine (Demerol), methadone (Dolophine), alphaprodine (Nisentil), levorphanol (Levo-Dromoran), anileridine (Leritine), and hydromorphone (Dilaudid).

The potent ***nonnarcotic analgesics*** do not fall under the narcotic regulations, but they do require a prescription. The ***mild analgesics*** do not require a prescription and are available over the counter. These are discussed in unit 19. Some of the prescription-only, nonnarcotic analgesics are propoxyphene hydrochloride (Darvon), ethoheptazine, and pentazocine (Talwin).

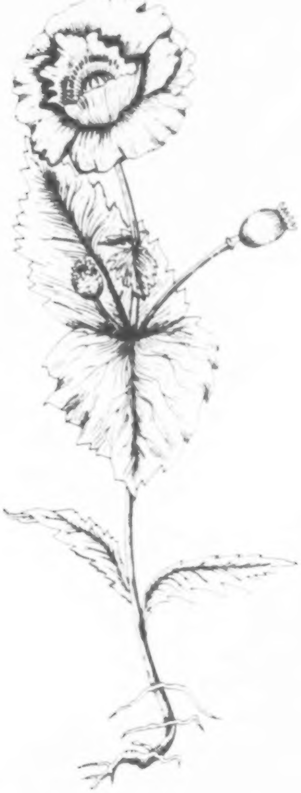


Fig. 2. Poppy (Papaver somniferum), *from which opium is extracted*

Another group of nonnarcotic analgesics, in addition to their pain-killing effects, indirectly have a significant anti-inflammatory effect. These drugs are used primarily for arthritic pain or pain associated with any inflammation. Many of these drugs are also referred to as the nonsteroidal anti-inflammatory analgesics. Corticosteroids, such as cortisone and hydrocortisone, are the most potent anti-inflammatories, but, because of their side effects, are limited in their usefulness for this condition. The nonsteroidal anti-inflammatory analgesics include phenylbutazone (Butazolidin, Azolid), oxyphenbutazone (Oxalid, Tandearil), indomethacin (Indocin), ibuprofen (Motrin), naproxen (Naprosyn), tolmetin (Tolectin), and sulindac (Clinoril).

ANESTHETICS

Anesthesia is a state of partial to total loss of feeling. Drugs used to produce anesthesia can be divided into general anesthetics and local anesthetics. *General anesthetics* produce a total loss of sensation and permit major surgery to be performed on patients. *Local anesthetics* produce a very localized loss of sensation that permits minor procedures to be performed (e.g., tooth extractions, lancing of a boil).

General anesthetics. General anesthetics are depressants of the central nervous system. The amount of depression depends on the dose of anesthetic used. Lower doses produce analgesia and loss of consciousness. Higher doses bring about a stage of surgical anesthesia, with analgesia, loss of consciousness, loss of muscle tone, and complete muscle relaxation. The degree of muscle relaxation depends on the anesthetic used.

General anesthetics fall into two major categories—volatile (inhalational) and nonvolatile (parenteral). Examples of volatile anesthetics include ether, nitrous oxide, halothane (Fluothane), and methoxyflurane (Penthrane). Examples of nonvolatile anesthetics include thiopental (Pentothal), thiamylal (Surital), fentanyl plus droperidol (Innovar), and ketamine (Ketaject, Ketalar).

Many of the general anesthetics do not induce enough muscle relaxation to permit deep abdominal or chest surgery. For this reason, a group of drugs called the neuromuscular blocking agents are used as adjuncts to the general anesthetics. These drugs by themselves are not anesthetics. Included in this group of drugs are curare or d-tubocurarine, gallamine (Flaxedil), and pancuronium (Pavulon).

Local anesthetics. Local anesthetics block nerve conduction when applied locally to nerve tissue in appropriate concentrations. The local anesthesia effect reverses rapidly, affording complete recovery without structural damage to the nerves. The most widely used local agents include the *-caine* family of drugs such as cocaine, procaine (Novocain), lidocaine (Xylocaine), mepivacaine (Carbocaine), bupivacaine (Marcaine), and benzocaine in many combinations.

MISCELLANEOUS CNS DRUGS

Lithium carbonate (Eskolith, Lithane) and *lithium citrate* (Lithonate-S) are used to treat the manic episodes of manic depression and to prevent the recurrence of mania in such patients. Lithium can be quite toxic, so great care must be used when patients are being treated with this drug.

SUMMARY

The nervous system maintains and integrates all body functions in response to external and internal stimuli. It consists of three principle parts—the brain, the spinal cord, and the nerves. The basic structural unit is the neuron or nerve cell. Three main groups of drugs act to stimulate the central nervous system. These groups are cerebral stimulants, convulsant stimulants, and antidepressants. Other agents act to depress all or selected parts of the central nervous system. Depressants are grouped into anticonvulsants, antiparkinson agents, sedative-hypnotics, antianxiety agents (tranquilizers), antipsychotic agents, narcotic and nonnarcotic analgesics, and anesthetics. Manic depression is treated with lithium compounds.

15

Hormones

Objectives: After completing this unit, you will be able to—

1. *discuss the differences between endocrine and exocrine glands;*
2. *list the major endocrine glands of the body;*
3. *list representative hormones from each of the major endocrine glands; and*
4. *briefly describe the functions of the major hormones in the body.*

TERMS AND DEFINITIONS

anabolism—constructive metabolism; building up

androgenic steroid—hormone from the adrenal cortex that stimulates the development of male characteristics

endocrine gland—a ductless gland that manufactures specialized materials for use elsewhere in the body and discharges them directly into the circulatory system

exocrine gland—a gland whose secretions are discharged through ducts

glucocorticoid—hormone from the adrenal cortex that protects against stress and affects protein and carbohydrate metabolism

glycogen—animal starch; storage form of glucose

gonads—sex glands; ovaries and testes

hormone—substance produced by an endocrine gland, or a drug that stimulates some other part of the body to increased activity or secretion

hyper—prefix meaning too much or a high amount

hypo—prefix meaning not enough or a low amount

islets of Langerhans—specialized cells in the pancreas that secrete insulin

mineralocorticoid—hormone from the adrenal cortex that affects the retention or secretion of sodium and potassium

The two types of glands in the body are exocrine glands and endocrine glands. *Exocrine glands* produce tears, sweat, saliva, gastric acid, digestive enzymes, and many other secretions. They secrete these substances through ducts that open onto the skin or the gastrointestinal tract.

The *endocrine glands* are referred to as the ductless glands. They release their secretions, the hormones, directly into the blood or lymph for transport to other parts of the body where they will exert their actions. Most hormones act quite selectively on specific tissues referred to as target tissues.

The physiological functions of hormones can be placed into three categories:

- Regulation of metabolism
- Stimulation of growth and development
- Alteration of nervous system function

The major endocrine glands are the pituitary gland, the thyroid gland, the parathyroid glands, the adrenal glands, the pancreas, the testes, and the ovaries. Refer to figure 1 for the location of these glands within the body.

The endocrine system, acting along with the nervous system, works to maintain a stable internal environment in the body. By secreting hormones, the endocrine glands act to maintain homeostasis despite changes in the internal and external environments. When excessive (hypersecretion) or deficient (hyposecretion) amounts of hormones are released, the homeostatic mechanisms become disrupted, and the individual has problems medically.

Hormones and hormonelike drugs have several basic uses in medicine. They are used to replace a missing hormone when the gland

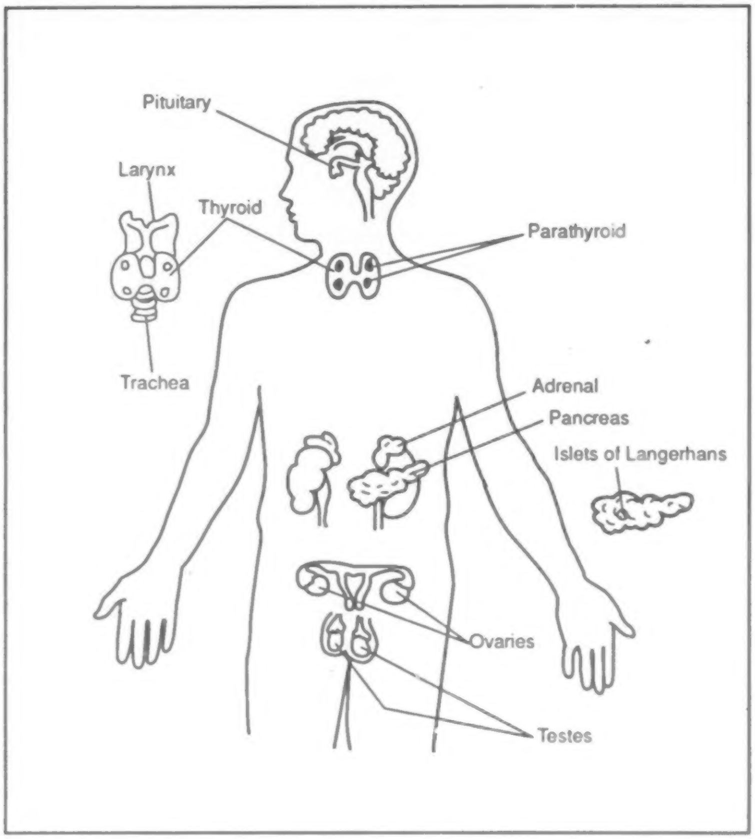


Fig. 1. The endocrine glands

normally producing it does not function. Hormones can be given to supplement a hormone when the gland normally producing it does not provide enough. Hormones can also be used to treat disease, to relieve symptoms, or to alter some bodily function or condition.

PITUITARY GLAND

The *pituitary* is a pea-sized gland located at the base of the brain. It secretes numerous hormones that regulate the secretion of hormones from other endocrine glands. For this reason, the pituitary gland is often referred to as the master endocrine gland. The gland is divided into three lobes, each producing its own hormones.

Anterior lobe of the pituitary. The anterior, or front, lobe of the pituitary gland secretes six distinct hormones.

Growth hormone (GH), or somatropin (STH), regulates growth, particularly skeletal growth throughout the body. Hyposecretion before puberty can cause dwarfism; hypersecretion before puberty can cause giantism. This hormone is commercially available under the trade name Asellacrin.

Thyroid-stimulating hormone (TSH) controls the normal development and function of the thyroid gland. (This hormone is not the thyroid hormone.) TSH is used primarily as a diagnostic agent to measure the extent of hypothyroidism. It is not used therapeutically. A trade name product is Thytropar.

Follicle-stimulating hormone (FSH), in females, stimulate the ovaries to produce estrogens and ova (eggs). In males, this hormone promotes the production of sperm in the testes.

Luteinizing hormone (LH), or interstitial cell stimulating hormone (ICSH), or luteal hormone, in females, stimulates the corpus luteum of the ovary to produce progesterone. In males, this hormone stimulates the secretion of testosterone from the testes.

Luteotropic hormone (LTH) or proplactin, in the female, affects mammary gland development and milk production after childbirth.

Corticotrophin, or adrenocorticotropic hormone (ACTH), controls the synthesis and release of hormones from the adrenal cortex. A trade name product is Acthar.

Posterior lobe of the pituitary. The posterior, or rear, lobe of the pituitary gland is known to secrete at least two hormones.

Vasopressin, or antidiuretic hormone (ADH), is a very powerful hormone affecting salt and water reabsorption in the kidneys and blood pressure regulation by vascular smooth muscles. Vasopressin for medicinal use is derived from the pituitary glands of domestic animals and also by chemical synthesis. A trade name product is Pitressin.

Oxytocin promotes contraction of the uterus at childbirth and the flow of milk during nursing. A trade name product is Pitocin.

Intermediate lobe of the pituitary. The intermediate, or middle, lobe of the pituitary gland secretes the melanocyte-stimulating hormone (MSH), which influences the deposition of melanin in the skin. Melanin is a pigment that gives the skin its color. The absence of melanin causes albinism.

THYROID GLAND

The *thyroid gland* lies just behind the upper part of the trachea and slightly below the larynx. Its two lobes produce two hormones, thyroxine and triiodothyronine, that act to accelerate the body's basal metabolic rate. Their deficiency results in hypothyroidism. Hypothyroidism may cause disturbances in muscular efficiency and activity, in circulation, and in the central nervous system. Hypothyroidism in children is called cretinism; in adults it is called myxedema. Thyroid preparations used in the treatment of hypothyroidism include dried (desiccated) thyroid, sodium levothyroxine (Letter, Synthroid), sodium liothyronine (Cytomel), thyroglobulin (Proloid), and liotrix (Euthroid, Thyrolar). Side effects of all these preparations look like overdose symptoms (i.e., symptoms of hyperthyroidism).

Hyperthyroidism is caused by the formation of too much thyroid hormone(s). It may also be caused by the overdosing of thyroid preparations. The treatment of this condition is aimed at stopping the production of excess hormones by the thyroid gland or by interrupting the events leading to the hyperthyroid condition. Mild forms of the disease may respond to treatment by drugs that interfere with the formation, release, or actions of the thyroid hormones. Examples of drugs used in hyperthyroid states include 5% iodine plus 10% potassium iodide solution, propylthiouracil, and methimazole (Tapazole).

PARATHYROID GLANDS

The *parathyroid glands* are located right behind each thyroid lobe. The four small glands secrete a hormone called parathyroid hormone, or parathormone (PTH). This hormone affects calcium concentration in the extracellular fluid by controlling calcium absorption in the gastrointestinal tract and calcium excretion in the kidney. This hormone also affects calcium deposition in the bones.

ADRENAL GLANDS

The two *adrenal glands* are each located above a kidney. Each gland consists of two parts, the adrenal medulla and the adrenal cortex. The adrenal medulla is the inner portion of the gland, and the adrenal cortex is the outer portion. The adrenal glands play a very important role in regulating many life functions.

Adrenal medulla and its hormones. The two principal hormones secreted by the adrenal medulla are epinephrine and norepinephrine. These chemicals serve as mediators in the autonomic nervous system. They stimulate the heart, induce vasoconstriction or vasodilatation depending on the organ system, increase the rate of carbohydrate metabolism, and increase central nervous system irritability.

Adrenal cortex and its hormones. About 40 chemicals have been isolated from the adrenal cortex. The most important functions of the adrenal cortical hormones involve salt metabolism, water and electrolyte balance, reproductive activity, muscle activity, fat metabolism, and immunological mechanisms. Adrenal cortical hormones are classified into glucocorticoids, mineralocorticoids, and androgenic steroids.

Glucocorticoids are concerned mainly with carbohydrate, fat, and protein metabolism. The two principal hormones secreted by the adrenal cortex are cortisone and hydrocortisone. They are secreted in response to ACTH from the pituitary gland. The glucocorticoids have a wide range of medicinal uses. In addition to the naturally occurring glucocorticoids, a great many of these hormones are produced synthetically. Representative glucocorticoids include cortisone, hydrocortisone (Cetacort, Cort-Dome, Hytone), prednisone (Deltasone, Meticorten, Orasone), prednisolone (Delta-Cortef, Meticortelone), triamcinolone (Aristocort, Kenacort), dexamethasone (Decadron, Hexadrol), and betamethasone (Celestone). The glucocorticoids have a wide range of routes of admission, depending on the use and the drug. They are used parenterally, topically, ophthalmically (in the eye), orally, and by inhalation.

Mineralocorticoids are concerned primarily with electrolyte balance and water distribution in tissues. The three major mineralocorticoids are aldosterone, desoxycorticosterone, and fludrocortisone. Desoxycorticosterone is available commercially as Percorten, and fludrocortisone is available as Florinef.

Androgenic steroids are chemically identical to the androgens secreted by the testes and have the same effects in the body (see the section below on the testes).

PANCREAS

The *pancreas* is a gland located behind the stomach. It secretes enzymes necessary for proper digestion and a hormone called insulin. Insulin is secreted by specialized cells of the pancreas called the islets of Langerhans. Insulin regulates carbohydrate metabolism by several mechanisms.

Insulin stimulates the production of glycogen by the liver and skeletal muscle. It promotes the uptake of glucose by the cells of the body. It inhibits the metabolism of fatty acids from the fat stores of the body. Sometimes the islets of Langerhans fail to secrete enough insulin for the body's needs. When this occurs, a condition of hypoinsulinism or *diabetes mellitus* ensues. Diabetes mellitus can occur at any age, but it begins most often between the ages of fifty and sixty.

There are generally two types of diabetes mellitus, juvenile onset and adult onset. In juvenile onset diabetes mellitus, insulin is not being produced at all by the pancreas. In these situations, insulin itself must be administered. In adult onset diabetes mellitus, the pancreas is secreting insulin, but not enough to meet the body's needs. For this type of diabetes, drugs are available that promote the secretion of insulin. These drugs are the oral hypoglycemics.

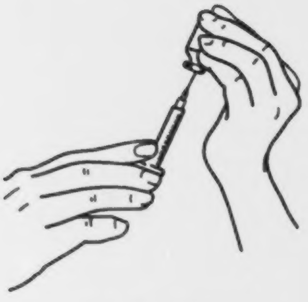
People with diabetes mellitus frequently have a high concentration of sugar (glucose) in the blood. The hypoglycemics are used to lower this elevated sugar (hyperglycemia) by promoting the secretion of insulin. The oral hypoglycemics available include tolbutamide (Orinase), tolazamide (Tolinase), acetohexamide (Dymelor), and chlorpropamide (Diabinese).

Since diabetes mellitus is primarily a metabolic disorder, proper diet is essential to its control. To compensate for inadequate or totally lacking insulin, various types of animal insulin can be used. The two main animal sources of insulin are beef and pork. Insulin can be obtained without a prescription as regular insulin, Protamine Zinc Insulin Suspension (PZI), Isophane Insulin Suspension (NPH), and the Lente insulins. These preparations differ mainly in the onset and duration of action and the substances used to prolong the action. Figure 2 shows the routes of administration for hypoglycemics. Figure 3 pictures the areas used for injections of insulin.

OVARIES

The two *ovaries* (female sex glands) are located on either side of the uterus. They act in response to the gonad-stimulating hormones secreted by the pituitary gland. The ovaries secrete two types of hormones, estrogens and progestogens. Normal reproductive development and activity depend on the proper balance between these two types of female sex hormones.

The *estrogens* include naturally occurring



A. Parenteral

B. Oral

Fig. 2. Routes of administration for hypoglycemics

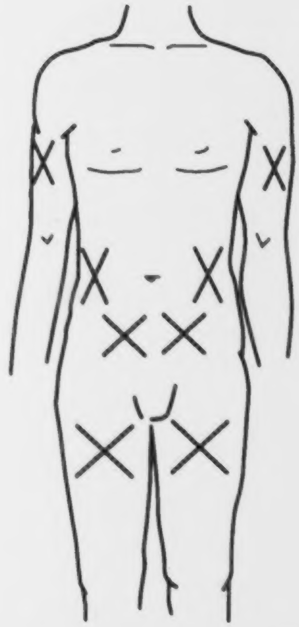


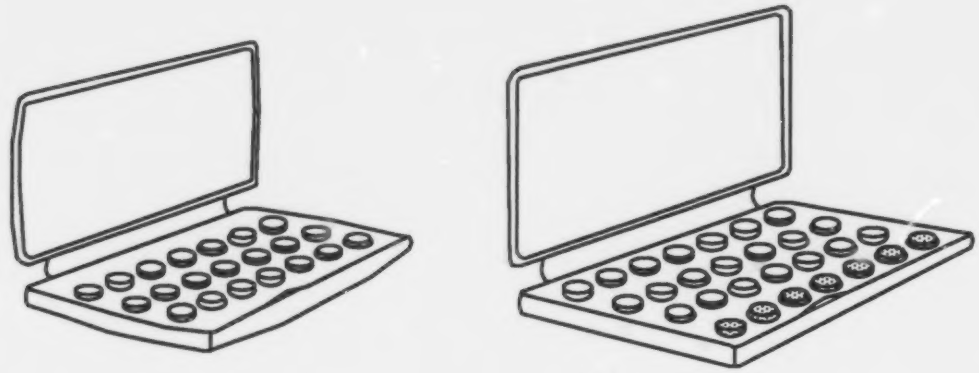
Fig. 3. Areas used for injections of insulin (Sites must be rotated.)

compounds and synthetic compounds that have the same effect. Estrogenic compounds are responsible for the development of the sex organs at puberty. They also control the development and maintenance of feminine secondary sex characteristics. Estrogens also control to some extent the development of the skeleton. Representative estrogens include estradiol (Dimenformon), estrogenic substances (Premarin), chlorotrianisene (TACE), amd dienestrol (Synestrol).

Progestogens are hormones having progestational activity (i.e., activity relating to changes in the ovaries during the menstrual cycle). Progesterone, the principal natural progestogen, prepares and maintains the uterine lining for implanting and nourishing the embryo. It also supplements estrogenic action on the uterus and mammary glands and suppresses ovulation during pregnancy. Representative progestogens are progesterone (Progestin), hydroxyprogesterone (Delalutin), medroxyprogesterone (Provera), and norethindrone (Norlutin).

Synthetic progestogens have numerous other actions as well. One major use is as oral contraceptives. They are almost always combined with estrogens for this purpose. Representative oral contraceptives include ethynodiol diacetate and ethinyl estradiol (Demulen), norethynodrel and mestranol (Enovid), norethindrone and mestranol (Norinyl, Ortho-Novum), norethindrone and ethinyl estradiol (Norlestrin), and ethynodiol diacetate and mestranol (Ovulen).

Combination products have both an estrogen and a progestogen and are taken for 20 days. The sequential products consist of two different tablets. One tablet containing only an estrogen is taken for 14 to 16 days. For the next 5 to 6 days, tablets containing both an estrogen and a progestogen are taken. Containers are prepared with tablets for a twenty-eight day hormonal cycle. A woman with the twenty-one day tablet container, shown in figure 4A, would refrain from taking pills for seven days. The twenty-eight tablet container, shown in figure 4B, has seven pills of inert ingredients (placebos) so that the customer/patient may habitually take a pill each day.



A. 21-day

B. 28-day

Fig. 4. Progestogens and estrogens are combined in oral contraceptives.

TESTES

The *testes* are twin male sex glands located in the scrotum. Like the ovaries, these glands respond to the gonad-stimulating hormones secreted by the pituitary gland. The group of hormones secreted by the testes are called *androgens.* They function much as the estrogens do in females.

Androgens control growth and development of male sex organs at puberty. They control and maintain development of secondary masculine characteristics, as well. In addition, they control formation and maintenance of muscle and skeletal proteins. Androgens also control the body's storage of many inorganic ions. Since females have small amounts of androgens also circulating, this function is seen in both sexes.

Efforts have been made to develop synthetic compounds that can be used to build up proteins of body cells (anabolism) while not causing any masculinization. These drugs are called the anabolic steroids and can be used in males and females to build up protein following surgery, in debilitating diseases, or in malnutrition. These are the steroids used by athletes to increase body size and strength, thus improving performance. Excessive use leads to marked personality changes and other undesirable effects. Representative male sex hormones are testosterone (Delatestryl), methyltestosterone (Metandren), methandrostenolone (Dianabol), and stanozolol (Winstrol).

SUMMARY

The endocrine system consists of six major glands: the pituitary, thyroid, parathyroids, adrenals, pancreas, testes, and ovaries. These ductless glands release their secretions (hormones) directly into the blood or lymph to control metabolism, stimulate growth, or alter the function of the nervous system. Hormones or hormonelike drugs have been developed to replace a missing hormone, supplement an insufficient supply, treat disease, relieve symptoms, and to alter some bodily function or condition.

16

Drugs for Infectious Diseases and Cancer

Objectives: After completing this unit, you will be able to—

1. *identify the major classes of anti-infectives;*
2. *list examples of drugs within the major classes of anti-infectives;*
3. *describe the problem of resistance to anti-infectives;*
4. *differentiate between narrow- and broad-spectrum antibiotics;*
5. *discuss the reason for multiple-drug therapy in the treatment of cancer; and*
6. *list the general categories of antineoplastic agents with one specific example of each.*

TERMS AND DEFINITIONS

antibiotic—drug derived from microorganisms
antineoplastic—antitumor agent; most often an anticancer drug
bacteria—microscopic, single-cell organisms
benign—not malignant
-cidal—agent that kills (e.g., bactericidal, fungicidal)
crystalluria—presence of crystals in the urine
DNA—deoxyribonucleic acid, the molecular basis of heredity in the chromosomes; responsible for the replication of the key life substances
drug resistance—exists when a strain of microorganisms is less sensitive or totally insensitive to drugs that ordinarily inhibit their growth or cause their death
fungus—a class of microorganisms; microscopic plants that differ from bacteria since they reproduce by means of spores; may be unicellular or multicellular
infection—the invasion of the body by a pathogen; also the tissue's reaction to such an invasion and to the toxins produced by the organism
infectious disease—disease caused by a pathogenic organism
malignant—cancerous; tending to spread (metastasize), grow worse, and resist treatment
neoplasm—tumor
parasite—organism that feeds or lives on or in another organism
pathogen—any microorganism or substance capable of causing disease
penicillinase—enzyme produced by certain bacteria that renders penicillin inactive
pharmacokinetics—the study of the metabolism and action of drugs with emphasis on the time required for absorption, duration of action, distribution in the body, and method of excretion
prophylaxis—measures designed to preserve health and prevent disease
rickettsia—class of microorganisms between bacteria and viruses in complexity
-static—agent that inhibits the reproduction of pathogens (e.g., bacteriostatic, fungistatic)
tubercle—lesion of tuberculosis
virus—extremely small infectious parasite invisible with an ordinary light microscope

Infectious diseases can range from life-threatening (e.g., bacterial meningitis) to inconvenient (e.g., the common cold). Infectious diseases involve all human organ systems. Many kinds of pathogenic microorganisms can cause infectious diseases—bacteria, rickettsia, viruses, protozoa, fungi, worms, and others. A large number of different anti-infective drugs have been developed to treat the variety of infectious diseases.

TYPES OF ANTI-INFECTIVES

Anti-infectives can be classified as either *static* or *cidal*. *Static agents* inhibit a pathogen from reproducing (e.g., bacteriostatic, fungistatic). This allows the host's normal body defenses to take over and fight the infection. *Cidal agents* are those that kill pathogens (e.g., bactericidal, fungicidal). There are many other designations for anti-infective drugs. Antiparasitics, for example, are agents used to kill parasites. Other specific names relate to the type of parasite killed, such as anthelmintics, antiamoebics, antifungals, and others.

Some anti-infectives are relatively nontoxic to the host (e.g., penicillin), while others can be extremely toxic (e.g., streptomycin). The severity and type of infection will sometimes require prescribing a drug with potential toxic effects. The physician must weigh the potential effects against the benefits.

Drugs can also be used prophylactically when people have been exposed to pathogens or have had surgery that put them at risk of infection. Some agents (e.g., vaccines) can be used to cause the body to produce its own antibodies against specific diseases.

DRUG RESISTANCE

Drug resistance is a significant problem in anti-infective therapy. *Drug resistance* occurs when a strain of microorganisms becomes less sensitive or totally insensitive over time to a drug that originally inhibited its growth or killed it. For example, when penicillin was first introduced into medicine about 1945, almost all infections caused by *Staphylococcus aureus* responded favorably to the drug. Resistant strains of the bacteria soon emerged, and today about 90 percent of all hospital staph infections are resistant to penicillin.

Drug resistance can be minimized by following certain measures, however. Physicians should not prescribe anti-infective agents indiscriminately. An anti-infective agent should be taken in large enough doses and for long enough periods of time to wipe out the infection rapidly and completely. Physicians should be careful to select anti-infectives that are appropriate for the type of microorganism responsible. Drugs should be used in combination whenever appropriate to take advantage of multiple modes of action. The pharmacy worker can help in these efforts to cut down on the problem of drug resistance. Workers can advise patients of the need to take the full course of medication even if their symptoms disappear before the medicine is used up.

SULFONAMIDES (SULFAS)

The sulfonamides were the first agents used systemically to prevent and cure bacterial infections. All of the sulfa drugs are derivatives of a chemical called amino-benzene-sulfonamide. Generally, the sulfonamides are bacteriostatic, although sometimes, in very high concentrations, they can become bactericidal. Drug resistance to sulfonamides is very common. This is why other antibiotics are preferred to sulfonamides in today's clinical practice. In a few situations, however, sulfonamides remain the drugs of choice.

Sulfonamides are usually administered orally because they are rapidly and adequately absorbed from the gastrointestinal tract. They can be injected, however, if the situation dictates.

The major sulfonamides include sulfadiazine (Suladyne), sulfisoxazole (Gantrisin), sulfamethoxazole (Gantanol), and sulfamethizole (Azotrex).

Trimethoprim is an anti-folic-acid agent that inhibits some bacterial growth. When it is used alone, resistance often develops. However, combining it with sulfamethoxazole greatly enhances the effectiveness of both agents. Combinations of trimethoprim and sulfamethoxazole are currently available under the trade names Septra and Bactrim. These combination products are used often to treat urinary tract infections and middle ear infections.

CRYSTALLURIA

One effect common to many sulfonamides is crystalluria. *Crystalluria* is the presence of crystals in the urine. Formation of these drug crystals in the kidney can lead to kidney failure. Different chemistry of many of the newer sulfonamides has alleviated this problem somewhat. Figure 1 shows sulfonamide crystals as they appear microscopically in acid urine specimens.

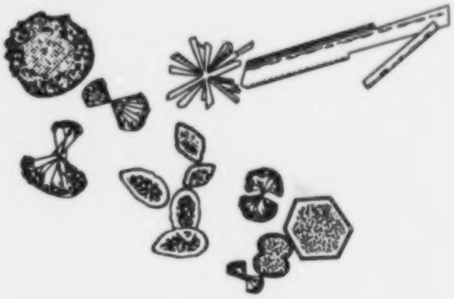


Fig. 1. Crystals from sulfonamide medication found in acid urine specimens

TYPES OF ANTIBIOTICS

All clinically useful anti-infectives are selectively toxic to some pathogens. The term antibiotic is generally reserved for drugs that are derived from microorganisms. Whether an antibiotic is bactericidal or bacteriostatic depends on the specific effects of the drug on the biochemical processes within the organism.

Antibiotics exert their antibacterial effects by inhibition of cell synthesis, inhibition of protein synthesis, and /or interference with the functions of the cell membrane.

Many antibiotics are used today. Some are naturally occurring, some are semisynthetic, and some are entirely synthetic. The antibiotics are classified as either narrow-spectrum or broad-spectrum antibiotics. ***Narrow-spectrum antibiotics*** are useful against only a few organisms, while ***broad-spectrum antibiotics*** are useful against a wider range of microorganisms. The choice of an antibiotic depends on its effect against a specific infecting microorganism and on the toxicity of the drug to the host.

Penicillins. Penicillin was the first antibiotic discovered. Originally, penicillin was derived from strains of ***Penicillium***, which is the mold often found on bread and fruit. Penicillium is shown in figure 2 as it appears microscopically. Now many forms are produced semisynthetically. Penicillins are primarily bactericidal. They are the most widely used of all the antibiotics against certain bacterial strains.

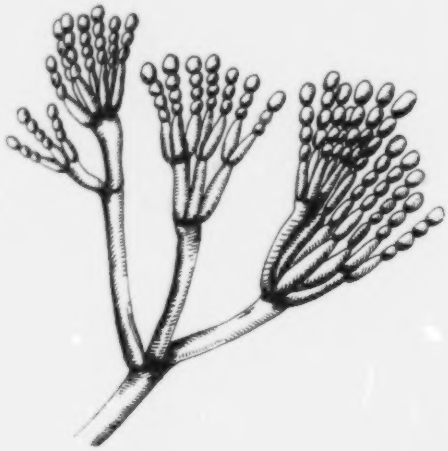


Fig. 2. Penicillium chrysogenum *is the mold from which penicillin comes.*

The emergence of penicillin-resistant strains prompted the development of newer semisynthetic penicillins. Some of the resistant strains have an enzyme (penicillinase) in the cell that breaks down penicillin, making it ineffective. The newer semisynthetic penicillins have been designed to be effective against these penicillinase-producing organisms. Semisynthetic penicillins also generally have a broader spectrum of activity than natural penicillin. Some of the forms of penicillin are destroyed in the stomach, so they must be administered parenterally.

Some of the most commonly prescribed penicillins are penicillin G potassium (Pentids), penicillin V potassium (PenVee, V-Cillin), oxacillin (Prostaphlin), ampicillin (Omnipen), and amoxacillin (Amoxil).

Tetracyclines. The tetracycline antibiotics were introduced soon after penicillin. The first, chlortetracycline, was isolated in 1948. Its discovery was the result of a systematic worldwide screening of soil samples in a massive search for antibiotic-producing microorganisms. Chlortetracycline has a wide range of antimicrobial activity. This drug and its derivatives are designated as broad-spectrum antibiotics. The tetracyclines are primarily bacteriostatic. They all have basically the same antimicrobial, pharmacological, and therapeutic properties. They differ mainly in varying rates of gastrointestinal absorption.

Tetracyclines are incompletely absorbed from the gastrointestinal tract. They also tend to cause some stomach upset in a large number of patients. It used to be recommended that the drugs be taken with food or milk to combat these gastrointestinal problems. Research has found, however, that the calcium ion in milk and other dairy products interferes with the absorption of tetracyclines, decreasing their effectiveness. This is an example of a drug-food interaction. Aluminum and magnesium ions present in many antacid products can also interfere with tetracycline absorption. This is an example of a drug-drug interaction. Patients should not take tetracyclines with any dairy products or antacids.

The major tetracyclines are chlortetracycline (Aureomycin), tetracycline (Achromycin, Panmycin, Tetracyn), oxytetracycline (Terramycin), demeclocycline (Declomycin), methacycline (Rondomycin), doxycycline (Vibramycin), minocycline (Minocin), and rolitetracycline (Syntetrin, Velacycline).

Cephalosporins. The cephalosporins comprise another class of antibiotics introduced during the late 1940s. While not members of the penicillin class, they are quite close chemical relatives. These agents are often prescribed for patients who are allergic to the penicillins. Some people who are allergic to the penicillins, however, are also allergic to the cephalosporins. The cephalosporins can also be used against some of the penicillinase-producing organisms where penicillin is ineffective. The cephalosporins are either bacteriostatic or bactericidal, depending on the sensitivity of the specific microbe.

Some of the cephalosporin antibiotics are cephalothin (Keflin), cephaloridine (Loridine), cefazolin (Ancef, Kefzol), cephaprin (Cefadyl), cefamandole (Mandol), cefoxitin (Mefoxin), cephradine (Anspor, Velosef), cephalexin (Keflex), and cephaloglycin (Kafocin).

Aminoglycosides. This group of antibiotics was developed when penicillin G proved ineffective in many infections. The aminoglycosides all share structural similarities and pharmacokinetic properties (poor absorption after oral administration; poor penetration into the spinal fluid; rapid excretion by the kidneys). The aminoglycosides are bactericidal, broad-spectrum antibiotics. They can also be quite toxic to the host, particularly to the ear and kidney. Resistance to aminoglycosides can also be a major problem. The aminoglycoside streptomycin was the first drug found to be effective in the treatment of tuberculosis. Despite some of its significant disadvantages, it remains an important drug in the management of TB.

Some of the aminoglycoside antibiotics are streptomycin, neomycin, gentamicin (Garamycin, tobramycin (Nebcin), kanamycin (Kantrex), amikacin (Amikin), and paromomycin (Humatin).

Erythromycin and related agents. Erythromycin (E-Mycin, Ilosone, Erythrocin, Ilotycin) was first isolated in 1952. It has antimicrobial activity similar to penicillin. Erythromycin has a low incidence of host toxicity and is often used to treat patients who are allergic to penicillin. Marked resistance to this antibiotic has, however, limited its usefulness. Two other antibiotics that have similar applications as erythromycin are lincomycin (Lincocin) and clindamycin (Cleocin).

Chloramphenicol. Chloramphenicol (Chloromycetin) is a broad-spectrum antibiotic that resembles the tetracyclines in its antimicrobial activity. Originally, this drug was isolated from a soil microbe, but now it is all prepared synthetically. Chloramphenicol is very toxic and should be used only when the causative microorganism has been positively identified and is known to be highly sensitive to the drug. It can cause aplastic anemia, an irreversible, often fatal blood disorder that is characterized by a decrease in all blood cells. This effect is not seen in all patients receiving the drug, but happens often enough to severely limit its usefulness.

Miscellaneous antibiotics. A few other antibiotics should be mentioned. These all have rather specialized uses and include colistin (Coly-Mycin), vancomycin (Vancocin), polymyxin B (Aerosporin), and bacitracin (Neosporin).

ANTITUBERCULAR AGENTS

Tuberculosis is still a somewhat common communicable disease. Incidence has increased with the spread of AIDS, which lowers the body's resistance to disease. It is caused by *Mycobacterium tuberculosis.* Tubercles (small, gray masses of granular tissue containing the microbe) form in tissue and spread throughout the body. Tuberculosis can affect any tissue of the body, but most often involves the respiratory tract.

Treatment is a complex, long-term procedure because of the disease's complex pathology and physiology and the persistence of the invading organism. Another major problem is the development of resistance to the antitubercular drugs that are employed. For these reasons, multiple-drug therapy is most often used against the invading organism.

Five drugs used in various combinations are considered first-choice drugs in the treatment of tuberculosis. These five are isoniazid or INH (Nydrazid), streptomycin, aminosalicylic acid or PAS, rifampin (Rifadin, Rimactane), and ethambutol (Myambutol). Second-choice agents, also used in combination, include cycloserine (Seromycin), viomycin sulfate, ethionamide (Trecator-SC), and pyrazinamide or PZA.

ANTIFUNGAL AGENTS

Human infections caused by fungi may involve deep skin layers, bones, internal organs, outer skin layers, hair, and nails. The superficial fungal infections include ringworms of the body, feet, scalp, and nails. Successful cure is often complicated by high rates of reinfection and the difficulty of applying the antifungal agents to the sites of infection. It sometimes takes weeks or months for the treatment of some fungal infections to be effective. The antifungal agents include nystatin (Bactocil, Prostaphlin), griseofulvin (Fulvicin-U/F, Grifulvin, Grisactin), flucytosine (Ancobon), amphotericin B (Fungizone), clotrimazole (Lotrimin), and miconozole (Mica Tin, Monistat).

ANTIMALARIAL AGENTS

Malaria is caused by a number of protozoan parasites. The infecting organism is injected into the blood by the bite of female *Anopheles* mosquitoes. The blood carries the organism to other areas of the body, particularly the liver and the spleen, where they multiply and reinfect those organs and other tissues. In any malarial treatment plan, the physician must consider the infecting organism, the stage the infection has reached, and the drug effective against the protozoa at that phase in its development. Antimalarial drugs include quinine, chloroquine (Aralen), quinacrine (Atabrine), primaquine phosphate, and pyrimethamine (Daraprim).

ANTINEOPLASTIC AGENTS

A *neoplasm* or *tumor* is a mass of new cells in the host. The growth of a tumor is not under the control of the host, nor does the tumor serve a useful purpose for the host. Neoplasms can be either malignant or benign. *Benign tumors,* such as warts or moles, grow relatively slowly and remain at their site of origin. *Malignant tumors* grow rapidly and spread (metastasize) to parts of the body distant from the site of origin. Malignant tumors, collectively called cancer, are composed of abnormal cells, are invasive, are capable of setting up secondary growth in other parts of the body, and are very destructive to the host.

Drugs useful against malignant neoplasms are termed *antineoplastic agents.* Depending on the type of neoplastic disorder, antineoplastic agents are used to cure the disease, prolong patient survival time, and/or make the patient more comfortable. Most of the effective agents are not selective, however. They damage normal cells as well as cancer cells. This is why these drugs produce many serious side effects. These drugs are often used in combination with each other, with radiation therapy, surgery, and immunotherapy. The antineoplastic drugs can be categorized as follows.

Alkylating agents. These drugs inhibit cell growth. Examples include nitrogen mustard (Mustargen), busulfan (Myleran), chlorambucil (Leukeran), melphalan (Alkeran), and cyclophosphamide (Cytoxan).

Antimetabolites. These drugs are similar in structure to normally present substances used by cells for growth and metabolism. They inhibit utilization of the normal substances, and the cells die. Examples of these agents include methotrexate, fluorouracil or 5-FU (Efudex, Fluoroplex), mercaptopurine or 6-MP (Purinethol), and cytosine-arabinoside or cytarabine.

Antibiotics. Most of these drugs bind to and inactivate DNA, thereby inhibiting cell growth and reproduction. These particular antibiotics are also quite toxic to the host, so they are not used as anti-infectives. Examples include actinomycin-D or dactinomycin (Cosmegen), doxorubicin (Adriamycin), bleomycin (Blenoxane), and mitomycin (Mutamycin).

Plant alkaloids. These drugs stop cell division with subsequent inhibition of growth. Examples include vinblastine (Velban) and vincristine (Oncovin).

Hormones. Depending on the type of cancer, the various sex hormones and corticosteroids are very useful as antineoplastic agents.

Miscellaneous antineoplastic agents. Examples here include procarbazine (Matulane), dacarbazine or DTIC, and some radioactive isotopes (e.g., P^{32}, Au^{198}, and I^{131}).

Very often, in the treatment of cancer, combination drug therapy is employed in order to take advantage of the multiple mechanisms of action of the various drugs.

SUMMARY

Infectious diseases affect all body systems and are caused by many kinds of pathogenic organisms. A very large number of different anti-infective drugs have been developed to treat these diseases. Static agents inhibit pathogenic reproduction, while cidal agents actually kill pathogens. Some organisms become less sensitive or totally insensitive to drugs. These are called drug-resistant pathogens. Anti-infective drugs include the sulfonamides, antibiotics, antitubercular agents, antifungal agents, and antimalarial agents. Antineoplastic agents are used against tumors to kill the disease, prolong patient survival time, or to make the patient more comfortable.

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Nonprescription Medications in the Pharmacy

Objectives: After completion of this unit, you will be able to—

1. *describe the role of self-medication with OTC products in the health care delivery system;*
2. *discuss how to know when OTC medication is appropriate;*
3. *list and discuss federal regulations for nonprescription drugs; and*
4. *evaluate the advertising of OTC products.*

People have tended to their own aches, pains, and illnesses over the centuries with various tried-and-true folk remedies. Indeed, ancient and traditional folk remedies are the basis for the development of modern pharmacology. Today people can buy nonprescription, over-the-counter medications for mild, usually short-term illnesses not requiring a physician's immediate attention. In fact, an estimated 40 million Americans use nonprescription medications daily. The American public spends 6 to 9 billion dollars a year on self-prescribed and self-administered drugs.

Self-medication with over-the-counter (OTC) drugs is recognized as an essential element in the health care delivery system. Knowledgeable patients who care for their own minor illnesses demand less of the more formal and more expensive system of health care. Physicians can concentrate on the diagnosis and treatment of more severe disease states, and can be concerned less with patients whose everyday symptoms can be alleviated with nonprescription medicines.

WHEN OVER-THE COUNTER MEDICATION IS APPROPRIATE

If self-medication is to have its proper place in the health care system, the patient and the pharmacy worker need to consider several important things.

The patient must be able to *tell when self-medication is appropriate.* The patient must decide if that dry cough, chest congestion, or nasal congestion is a symptom of a minor illness that is self-limiting or indicative of a serious illness.

The patient must be able to *select the OTC products that are most likely to help* (see fig. 1). At this point, the knowledgeable pharmacy worker plays a vital role in the health care delivery system. A knowledgeable pharmacy worker can help the patient select the products that will alleviate the symptoms. The pharmacist and others who work in the pharmacy can provide important information on OTC drugs to people in their community. Consumers must be made to feel free to ask for that information (see fig. 2).

The patient must be able to *take the medicine correctly.* This means understanding the manufacturer's directions regarding administration, dosage, and intervals—another area where the pharmacy worker can be of service.

The patient must be able to *recognize when to discontinue self-medication and consult a doctor.*

OVER-THE-COUNTER REGULATION

The widespread use of nonprescription drugs spawned the need for control over these products for the safety of the American public

Fig. 1. The patient must be able to select the OTC product that is most likely to help.

early in this century. The continuing dramatic expansion of the OTC market during the past 80 years has prompted much regulatory legislation.

The *Pure Food and Drug Act (1906)* stated that drugs must meet standards of strength and purity claimed by the manufacturer, and the products containing opiates must say so on the label.

The *Sherley Amendment (1912)* stated that the manufacturer may not make false therapeutic claims about a product. This amendment was difficult to enforce because the burden of proof was placed on the government.

The *Food, Drug, and Cosmetic Act (1938)* stated that new drug products must be approved as safe before marketing. However, it said nothing about the drug having to be effective.

The Durham-Humphrey Amendments (1951) were amendments to the Food, Drug, and Cosmetic Act, which divided drugs into the two major classes of prescription and nonprescription drugs. Nonprescription drugs were drugs for which directions for safe use by the public could be written. These drugs were also deemed to be safe to use without medical supervision.

Fig. 2. Pharmacy workers can provide important information on OTC drugs.

The *Kefauver-Harris Amendments (1962)* were also amendments to the Food, Drug, and Cosmetic Act. They simply stated that the manufacturer must establish the safety and effectiveness of all drugs marketed after 1938.

The *NAS-NRC-FDA Drug Efficacy Study (1966)* was made under contract with the FDA. The National Academy of Sciences-National Research Council undertook the evaluation of more than 3,400 new drugs that entered the market between 1938 and 1962, including 512 OTC drugs. These evaluations included safety and efficacy studies.

The *FDA OTC Drug Products Evaluation Program (1972)* was a review program established by the FDA. In 1972, the FDA charged 17 panels of experts to begin a review of the active ingredients of all OTC drug products to evaluate their safety and efficacy. The goals for the program were:

- To identify safe and effective ingredients for OTC drug products
- To establish acceptable combinations of ingredients and their rationale for inclusion in products
- To define safe and effective dose ranges for the ingredients in OTC products
- To determine that the manufacturer's claims for indications for self-medication are therapeutically acceptable

- To determine the information to appear on OTC labels, including indication, directions for use, and appropriate warnings and cautions
- To develop acceptable testing methods for each pharmacological category of ingredients to determine safety and effectiveness for use

The FDA adopted the idea of looking at classes of drugs instead of individual products. The estimated 300,000 OTC drug products now available actually contain only about 500 significant active ingredients. All OTC drugs will eventually be classified by the FDA in one of three categories:

Category I—generally recognized as safe and effective for the claimed therapeutic indication

Category II—not recognized as safe and effective

Category III—additional data needed to decide the safety and effectiveness

Each panel of experts consists of at least one pharmacist and one toxicologist, plus physicians and other specialists representing both consumer and industrial interests. The FDA has usually accepted the panel's recommendations. In a few cases, ingredients have been found to be so unsafe that the panels have recommended immediate removal from the market.

REQUIREMENTS FOR OVER-THE-COUNTER PRODUCT LABELS

Nonprescription drugs must be labeled with certain information so that the consumer can use the products intelligently. Information on an over-the-counter product label must include:

- *Brand name*—also called the trade name
- *Dosage instructions*—the strength of the medication and the correct dosage at the correct intervals
- *Active ingredients*—a list of all the active ingredients and the strength of each ingredient
- *Symptoms for treatment*—the symptoms the active ingredients will therapeutically treat
- *Cautions*—statements about overusage and certain medical disorders with which the product should not be taken
- *Possible side effects and interactions*
- *When to contact a physician*
- *Name and address of the manufacturer*

ADVERTISING AND OTC PRODUCTS

The manufacturers of over-the-counter products spend billions of dollars in promoting their specific products. Consumers must be aware of advertising practices and should not judge an over-the-counter product on the basis of having seen it advertised on television. Refer to figure 3 for types of sales promotions. Remember that nonprescription medications are intended to relieve symptoms, not cure. If symptoms persist, the patient should see a physician. In many instances, time and the body's own defenses will do the healing. The patient who has any question about the advertised product or about a product that is similar in activity but less expensive should ask the pharmacist or a knowledgeable employee for assistance.

SUMMARY

Self-medication with over-the-counter drugs plays an important part in the health care delivery system. A person needs to know when self-medication is appropriate and when to consult a doctor. Many laws have been passed by the federal government to ensure the safety and efficacy of drugs. Drugs are now put into three main categories as to safety and effectiveness. Even the content of nonprescription drug labels has been designated so that the consumer can use the product intelligently. Consumers must beware of advertising practices when selecting a nonprescription drug.

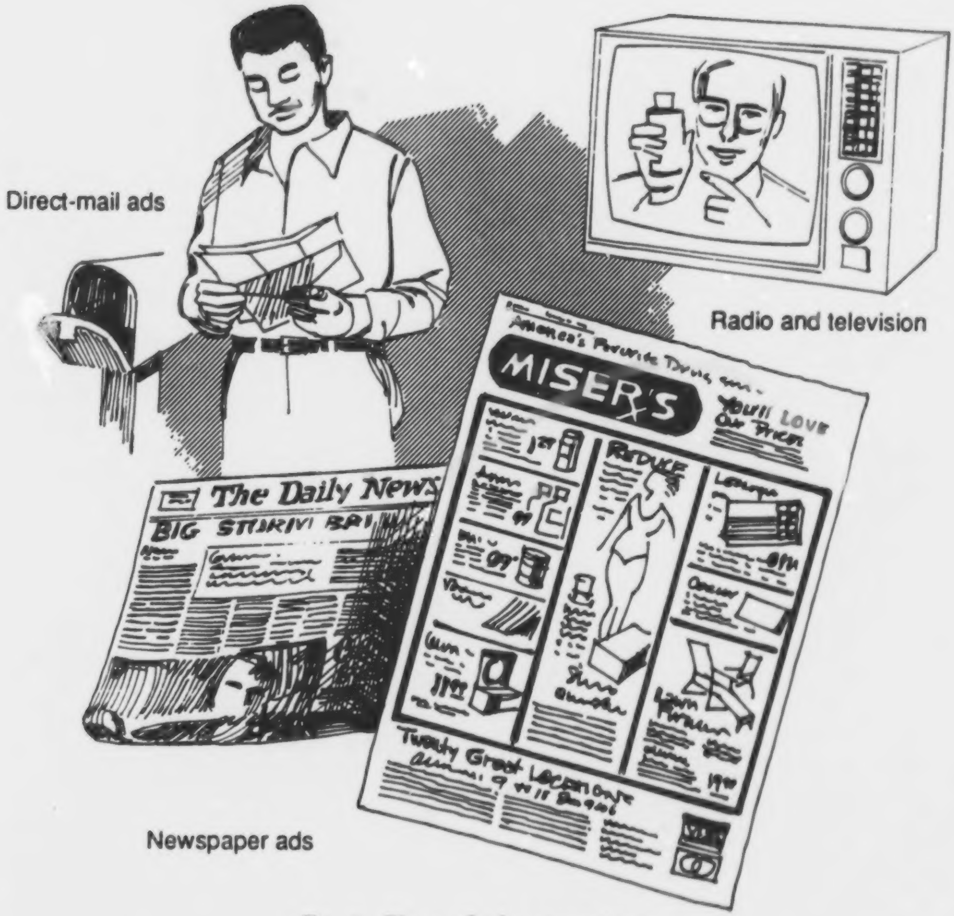
Direct-mail ads
Radio and television
MISER'S
You'll Love Our Prices
The Daily News
BIG
Newspaper ads

Fig. 3. Types of sales promotions

BEST COPY AVAILABLE

18

Nonprescription Gastrointestinal Products

Objectives: After completing this unit, you will be able to—

1. *identify the main objectives of treatment with antacids;*
2. *list the main ingredients in selected nonprescription antacids;*
3. *tell when and how to obtain the best results from antacids;*
4. *name the various causes of diarrhea;*
5. *list the ingredients in the most common over-the-counter products for diarrhea;*
6. *describe the common uses for laxatives;*
7. *differentiate between different types of laxatives; and*
8. *identify ingredients in OTC laxative products.*

TERMS AND DEFINITIONS

adsorbent—a substance that readily absorbs, such as activated charcoal or kaolin
acid rebound—overcompensation with the production of more acid
alkalinization—neutralization of the acid in the stomach
alkalosis—a condition in which the alkalinity of the body tends to increase beyond normal
antacid—an agent that reduces or neutralizes acidity, especially in the digestive tract
cathartic—a substance that helps produce bowel movements
defecation—evacuation of the bowels; expulsion of feces
diarrhea—frequent passage of watery bowel movements
feces—body waste discharged from the bowels
flatus or *flatulence*—excessive gas in the digestive tract
gastritis—inflammation of the gastric mucosa in the stomach
gastrointestinal motility—activity and movement of gastrointestinal tract
intestinal flora—bacteria normally found in the gastrointestinal tract
opiates—habit-forming drugs derived from opium, such as morphine and paregoric
palatable—pleasing to the taste
peristalsis—progressive, involuntary wavelike movement in the gastrointestinal tract that moves the contents of the intestine
regurgitation—return of solids or fluids to the esophagus or mouth from the stomach
systemic—affecting the body generally
toxin—a poisonous substance of animal or plant origin

Americans spend many millions of dollars in pharmacies and other retail outlets on nonprescription products for the treatment of gastrointestinal distress. This distress includes various types of indigestion, acute and infectious diarrhea, and constipation. Antacids, laxatives, adsorbents, opiates, antispasmodics, and antisecretory agents are used for the self-medication of these conditions.

CONDITIONS REQUIRING ANTACIDS

Antacid products are agents that reduce or neutralize acidity, especially in the digestive tract. People usually use antacids to treat "indigestion," which can be acid indigestion, sour stomach, heartburn, and many other symptoms of gastrointestinal distress. The distress may result directly from overeating, or it may be a recurrent symptom signaling a more serious illness. Several diseases, including heart disease and peptic ulcers, have indigestion as a symptom. Indigestion may also be a side effect of many prescription drugs, such as antibiotics, cortisone drugs, and antiarthritis medicines. Drug-induced indigestion can usually be alleviated by taking the medication on a full stomach or with milk. This procedure, however, may lessen the effectiveness of certain antibiotics by reducing their absorption.

Physicians may recommend nonprescription antacids for certain conditions:

- Indigestion from overeating (the most common)
- Gastritis (inflammation of the mucosa in the stomach)
- Esophageal regurgitation (backward flow of stomach contents into the esophagus)
- Various types of gastrointestinal ulcers

Antacids are the treatment of choice for acute gastritis and are also part of treatment of peptic ulcer disease. Ulcer therapy is unique in that nonprescription medications are central to its medical management.

TREATMENT WITH ANTACIDS

The objective of treatment with antacids is to reduce or neutralize acid in the stomach. Antacids do not actually neutralize all of the stomach acid. The liquid or suspension form of an antacid seems to be more effective than the equivalent dose in tablets. Tablets must be thoroughly chewed, or they may not dissolve completely in the stomach.

An antacid taken 1 hour after a meal can reduce acidity for as long as 3 hours. Antacids ingested on an empty stomach work for much shorter periods of time, only about 20 to 40 minutes. Foods act somewhat as a buffer to prolong antacids' actions.

DRUG INTERACTIONS

Antacids are involved in many drug interactions, the most significant of which is the interaction between antacids and certain tetracycline antibiotics. The antacid and the tetracycline, when combined, form insoluble, nonabsorbable complexes that the body is incapable of using. Antacids generally reduce the absorption of most other medications, as well. The sodium in some antacids has been shown to cause problems in some patients. Sodium content is an important consideration for people with hypertension or congestive heart failure, and for others who must restrict sodium intake. The salicylate in some products can cause other problems.

Some medications, however, can be given with antacids, particularly those prescription medications that by themselves can significantly cause gastric upset.

INGREDIENTS IN NONPRESCRIPTION ANTACID PRODUCTS

Some of the more common active ingredients in nonprescription antacid products follow.

Sodium bicarbonate (baking soda) is a potent and effective antacid. It is completely soluble in gastric secretions. Large doses or prolonged usage of sodium bicarbonate, however, may occasionally lead to systemic alkalosis. *Systemic alkalosis* occurs when the blood becomes too alkaline or basic because of either an excess of alkalies or a withdrawal of acid or chlorides from the blood. Sodium bicarbonate can also cause acid rebound. *Acid rebound* occurs when the stomach responds to excessive alkalinization by increasing its acid output. Sodium retention is also a problem with sodium bicarbonate use, because the sodium will cause significant fluid retention with prolonged usage. This is of major concern for congestive heart failure patients and people on salt- or sodium-free diets.

Calcium carbonate is a commonly used antacid with rapid, prolonged, and potent neutralization of gastric acid. In large doses, however, the medication tends to cause constipation. A more serious long-term side effect with prolonged usage is an increase in calcium levels in the blood. High calcium levels in the blood may cause impaired kidney function and possible kidney stone formation. This is much more likely to occur in patients who consume large amounts of milk or who have a history of kidney dysfunction.

Aluminum hydroxide is another antacid ingredient whose primary side effect is constipation. Aluminum hydroxide is commonly used with magnesium hydroxide to minimize constipation. Aluminum hydroxide has less neutralizing capacity than magnesium hydroxide. Aluminum compounds also decrease the absorption of phosphate in the intestine, a beneficial side effect for kidney patients who have elevated blood phosphate levels.

Magnesium hydroxide is an antacid ingredient with a major side effect of diarrhea. To combat this effect, it is often used with aluminum hydroxide (see above). Magnesium hydroxide may be purchased as Milk of Magnesia. Milk of Magnesia in small doses works as an antacid. However, in larger doses (2 to 4 tablespoonfuls of liquid, or 6 to 8 tablets) it is considered a laxative. Patients with chronic kidney disorders should not use Milk of Magnesia or other magnesium antacids on a regular basis, because more than 3 teaspoonfuls (or more than four tablets) per day of milk of magnesia exceeds the safe limit of magnesium set by the FDA for chronic kidney patients.

Magaldrate is a chemical combination of magnesium hydroxide and aluminum hydroxide. A trade-name product that uses this combination is Riopan (Ayerst Laboratories). A unique feature of Riopan is its extremely low sodium content. The low sodium content is a major advantage for congestive heart failure patients and others on salt or sodium-free diets.

Simethicone is not an antacid, but it is commonly used in many over-the-counter antacid products. Simethicone is an antiflatuent (that is, it reduces excessive gas in the digestive tract). As a gastric defoaming agent, it causes gas bubbles to be broken up into a form that can be eliminated more easily by belching or passing flatus.

EVALUATION OF ANTACIDS

Different OTC antacids contain different combinations of these agents. The patient should evaluate the formula, its neutralizing capacity, the intended use, and the palatability. For best results, antacids should be used one hour after meals, and at bedtime for maximum duration. If there is a change in bowel habits, the patient should change antacids. Patients on low-sodium intake (especially congestive heart failure and hypertensive patients) should select low-sodium antacid products.

Product selection should be based not only on the price but also on the relief obtained from the product. Consumers should not disregard a good product because of price. Most patients will select antacids on palatability or taste as well as relief obtained. Patients should not always select the most highly advertised product.

DIET AND INDIGESTION

Dietary restrictions can also be of benefit in obtaining relief from indigestion. If a certain food or beverage consistently causes gastric distress, it makes more sense to eliminate it from the diet than to use antacids. Foods to be avoided include caffeine-containing products (cola drinks, coffee, and tea) and alcohol.

Remember that persistent, repeated, or painful episodes of indigestion may be a symptom of a more serious condition. In that case, the patient should see a physician.

TYPES AND CAUSES OF DIARRHEA

Normal healthy bowel habits may vary greatly from person to person and from time to time. Diarrhea, however, is usually a symptom of gastrointestinal disturbance, characterized by abnormal, frequent passage of watery bowel movements. It is often short-term, and home remedies and nonprescription agents can provide distinct relief. Chronic or severe diarrhea may be a symptom of a condition requiring a physician's attention.

There are basically two general types of diarrhea, acute and infectious. *Acute diarrhea* may be caused by toxins, drugs, or diet, or it may be a symptom of another illness. Toxins found in contaminated food cause the diarrhea associated with food poisoning. Common antibiotics such as lincomycin, ampicillin, and tetracycline cause diarrhea by disrupting the normal intestinal bacterial flora. Antacids containing magnesium are also capable of provoking diarrhea, as magnesium is a laxative. Certain diets may also disrupt intestinal flora or irritate the digestive tract and cause diarrhea.

Infectious diarrhea is caused by bacteria (most common in adults) or by viruses (more often seen in children). In the United States, the bacteria most often responsible for diarrhea in adults are *Salmonella, Shigella,* and enteropathic *E. coli.*

Remember that diarrhea that persists or is accompanied by fever, bloody stools, or severe abdominal pain may indicate a serious illness. The patient should stop self-medication and see a doctor.

DIARRHEA IN INFANTS

Diarrhea in babies and young children is not uncommon. The cause of the diarrhea cannot always be identified. Acute diarrhea in infants is often caused by viral infections of the intestinal tract. Diarrhea in infants and young children may also be caused by the diet, or by systemic or local bacterial infections. Often, medication that an infant is taking causes diarrhea. Sometimes the infant's formula is the source of the diarrhea. In that case, selecting the proper formula with the help of a pediatrician will clear it up.

Acute diarrhea in infants requires a physician's care. A baby with acute diarrhea will lose an extremely large quantity of water and electrolytes over a short period of time. Loss of body fluids in infants can lead to circulatory collapse and kidney failure. Infants with acute diarrhea should always be referred to their pediatricians.

TRAVELER'S DIARRHEA

People visiting foreign countries with warm climates and relatively poor sanitation will sometimes develop a case of acute diarrhea, called traveler's diarrhea. This form of diarrhea is most often caused by the bacteria *E. coli.* Traveler's diarrhea usually results from exposure through food or drink to a different microbial population, which changes the bacterial flora of the GI tract.

EVALUATING A PATIENT/CUSTOMER'S CONDITION

When someone comes to you for advice about medication for diarrhea, you should ask several questions about the situation.

- *What is the patient's age?* Is the patient an infant, a healthy young adult, or an older person? Knowing the patient's age will help you decide what to recommend.
- *When was the onset of symptoms?* When did the stomach cramping and diarrhea begin? Was it right after a meal? Have there been previous episodes of diarrhea? If the condition is chronic or severe, you should refer the person to a physician.
- *Are there external factors?* Diarrhea can be caused by anxiety, nervousness, or stress. For example, you may find that the patient has an important exam coming up or has to give a presentation before a large group.
- *What has been the past treatment?* Before recommending treatment, the pharmacist should know what the patient has already tried.

TREATMENT OF DIARRHEA

More than 100 nonprescription products are available in the United States for treatment of diarrhea. Most of them are some form or some combination of the following four agents.

Adsorbents are the most frequently used agents in over-the-counter antidiarrheal preparations. They are usually taken after each loose bowel movement. They are clays that absorb toxins and bacteria that may be causing the diarrhea. The most common adsorbent is kaolin. Pectin is often combined with kaolin in antidiarrheals. Pectin is a carbohydrate derived from fruit and vegetables that acts to consolidate the stool. Kaopectate is a combination of these two agents. Quite often, either opiates or antispasmodics and antisecretory agents are used in combination with kaolin and pectin.

A disadvantage of these agents is that they also absorb drugs and other substances that may be of benefit.

Opiates, including opium powder, tincture of opium, and paregoric, are central nervous system depressants used in antidiarrheal products. They decrease gastrointestinal motility by slowing down the peristaltic movement of the gastrointestinal tract. Agents that contain paregoric (e.g., Parepectolin, Infantol Pink) have to be signed for by the patient on a narcotic register. Paregoric sold by itself requires a prescription in Texas. Patients taking other central nervous system depressants in combination with the diarrhea remedy are in danger of being oversedated.

Anticholinergics are also called antispasmodics and antisecretory agents. The most commonly used agents are the belladonna alkaloids. They include atropine sulfate, hyoscyamine sulfate, and hyoscine hydrobromide. These drugs decrease the secretions of the gastrointestinal tract. They also cut down on the cramping and muscle spasms associated with diarrhea. The most common over-the-counter product containing these drugs is Donnagel. The belladonna plant, whose antidiarrheal properties have been known since Medieval times, is shown in figure 1.

Lactobacillus preparations are often used to replace the intestinal bacterial lost because of acute diarrhea, especially in children. Lactobacilli are bacterial organisms, and these preparations must be refrigerated or the bacteria will die. Lactinex and Bacid are examples of lactobacillus preparations.

Remember that treatment of diarrhea affords symptomatic relief only. Symptomatic relief must not be interpreted as a cure. The over-the-counter products bear the warning "Do not use for more than 2 days or in the presence of high fever or in infants or children under 3 years of age unless directed by a physician." Diarrhea, if it persists, can indicate serious illness, especially in children.

LAXATIVE PRODUCTS

Constipation may be defined as infrequent or difficult defecation, with passage of unduly hard and dry fecal material. Most cases of constipation cure themselves without the use of drugs. Proper diet, exercise, adequate fluid intake, and regular bowel habits will often alleviate the condition.

In cases where treatment is required, a laxative can be beneficial. A *laxative* is a mild cathartic agent that enables the bowels to evacuate without pain. However, laxative can at times cause severe cramping and pain. If this occurs, the patient should see a physician. Laxatives are medically indicated for some conditions. Some common uses of laxatives include:

- Use by people who must avoid strain during evacuation (e.g., pregnant women, patients with hemorrhoids, some heart patients)
- Use before radiological bowel examination (e.g., a lower gastrointestinal series of tests)
- Treatment of acute constipation

CAUSES OF CONSTIPATION

Some of the common causes of constipation include the following.

Irregular bowel habits are developed over a long period, inhibiting the normal defecation reflex.

Faulty eating habits include not drinking enough fluids and not eating enough bran, whole grain cereals, fruit, and fresh vegetables. Not eating at regular times can also be a factor.

Stress and emotions can cause the anal spincter to be unable to relax. Relaxation of this sphincter muscle is necessary for normal evacuation.

Food and drugs can cause constipation. A few of the many foods are cheese and other dairy products, white breads, and crackers. Some of the types of drugs that can cause constipation are the antihistamines, narcotics, diuretics, tranquilizers, and some blood pressure medications.

Organic causes for constipation include blockages of the gastrointestinal tract, lack of muscle tone caused by the aging process, and peptic ulcers. Chronic constipation may be a symptom of an underlying organic condition requiring separate treatment.

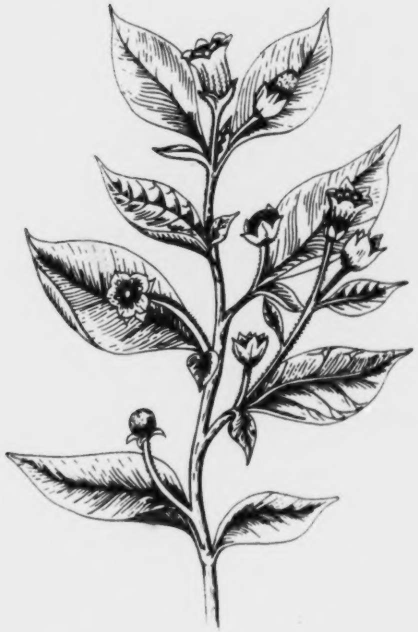

Fig. 1. Belladonna plant (Atropa belladonna), *from which the belladonna alkaloids are taken*

THE IDEAL LAXATIVE

The ideal laxative would be nonirritating and nontoxic, and would act only on the descending and sigmoid colon. It would act within a few hours to produce a normally formed stool. The ideal laxative would then cease activity to permit resumption of normal bowel activity. Unfortunately, there is no ideal or entirely harmless laxative. All types have some disadvantage. The distinction that the advertisers of commercial products make between mild laxatives and harsh cathartics is deceptive. Any medication taken by mouth to promote evacuation of the intestine is a cathartic agent. A laxative is simply a mild cathartic.

CLASSES OF LAXATIVES

Laxatives can be grouped into the following general classes.

Saline laxatives. The active ingredients of saline laxatives are relatively nonabsorbable ions of salts, such as magnesium, sodium, phosphate, citrate, and sulfate. These ions cause retention of water in the intestine. The increased pressure due to accumulation of fluid increases intestinal motility.

Saline laxatives are indicated for routine use only in situations such as preparation for gastrointestinal exam or elimination of drugs in suspected poisonings. Saline laxative should not be used in the long-term management of constipation. Some examples of saline laxatives are magnesium citrate (Evac-Q-Kit), magnesium sulfate (Epsom salts), sodium phosphate (Fleet Phospho-Soda), and magnesium hydroxide (Milk of Magnesia).

Stimulant laxatives. Stimulant laxatives increase the peristaltic activity (rhythmic contraction and relaxation) of the intestine. They irritate the mucosa of the intestinal smooth muscle, thereby increasing motility. The intensity of action of the stimulant laxative depends on the dosage (the higher the dose, the greater the intensity). Stimulant laxatives can produce spasmodic pain and increased mucous secretion. They are contraindicated when abdominal pain, nausea, or vomiting is present. These symptoms may also indicate appendicitis, and in appendicitis a stimulant laxative could cause very serious complications.

Stimulant laxatives such as castor oil and bisacodyl (Dulcolax) are often used before X-rays of the gastrointestinal tract and also before bowel surgery. Other examples of stimulant laxatives include cascara, senna compounds, and phenolphthalein. Figure 2 shows the castor bean plant, from whose seeds castor oil is derived.

Bulk-forming laxatives. The bulk-forming laxatives produce an action most similar to the natural mechanism in promoting evacuation. For this reason, they are often recommended for simple constipation. These laxatives are natural and semisynthetic polysaccharides and cellulose derivatives, which dissolve or swell in the intestinal fluid, thus increasing the bulk of the contents of the gastrointestinal tract. This type of laxative is usually effective in 12 to 24 hours, but it may take as long as 3 days to work. It is important that each dose of this type of medication be taken with a full glass of water so that the laxative has ample fluid in which to dissolve or swell.

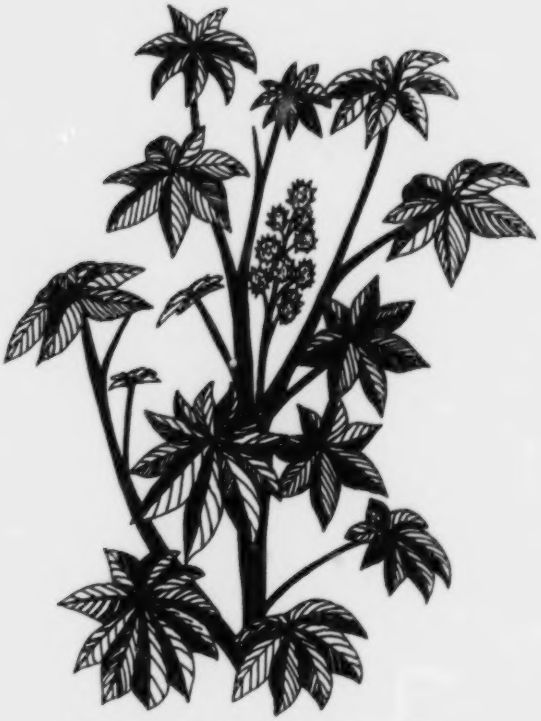

Fig. 2. The castor bean plant (Ricinus communis), *from whose seeds castor oil is derived*

Bulk-forming laxatives may interact with other drugs. Digitalis glycosides and salicylates should not be taken at the same time, because the laxative can slow down or inhibit their absorption.

Examples of bulk-forming laxatives include Metamucil, LA Formula, Effersyllium, Konsyl, and Maltsupex.

Emollient laxatives. These laxatives act as surfactants, or surface-active agents. They work in a manner similar to dishwashing soap or detergent. They facilitate the formation of oil-in-water emulsions of the aqueous and fatty substances within the fecal mass and thereby soften the stool. Another name for this type of laxative is a stool softener. The emollient laxatives are often combined with stimulant and bulk laxatives. Examples of emollient laxatives include dioctyl sodium sulfosuccinate (DSS) and dioctyl calcium sulfosuccinate (DCS). Some tradename products for these emollients are Colace, Surfak, Peri-Colace, and Doxidan.

Lubricant laxatives. The lubricant laxatives, such as Haley's M-O and mineral oil, soften the fecal contents by coating them with oily substances. This prevents the colon from absorbing the water from the material. Mineral oil should not be taken with meals, because it can delay emptying of the stomach. Excessive use can cause a decrease in the absorption of fat-soluble vitamins, leading to deficiencies in vitamins A, D, K, and E.

EXCESSIVE USE OF LAXATIVES

Common signs of excessive use of laxatives are diarrhea and vomiting. Excessive use can also lead to the more serious problems of fluid loss and electrolyte imbalance, especially of potassium. Prolonged use of laxatives tends to cause the smooth muscle of the intestine to atrophy (waste away). This general loss of muscle tone of the intestine diminishes peristaltic movement. When this occurs, the patient must continue laxative use in order to defecate. For all intents and purposes, the patient at this point is "hooked" on laxatives.

A laxative should only be used as a temporary measure. Therapy with any laxative should be limited in most cases to short-term use. If therapy is needed for more than a week, a physician should be consulted.

SUMMARY

Antacids are used to treat indigestion due to overeating, gastritis, esophageal regurgitation, or ulcers. Because antacids are involved in many drug interactions, care must be exercised in their use with other medications. Ingredients found in antacids include sodium bicarbonate, calcium carbonate, aluminum hydroxide, magnesium hydroxide, magaldrate, and simethicone.

Diarrhea, a disturbance of the GI tract, may be acute or infectious. Acute diarrhea is caused by toxins, drugs, or diet, or may be a symptom of another illness. Infectious diarrhea is caused by bacteria or viruses. Four agents are used to treat diarrhea—adsorbents, opiates, anticholinergics, and lactobacillus preparations.

Constipation is infrequent or difficult defecation. It is treated with a laxative or cathartic. Laxatives can be grouped into saline laxatives, stimulant laxatives, bulk-forming laxatives, and emollient laxatives. A laxative should only be used as a temporary measure.

19

Analgesics

Objectives: After completing this unit, you will be able to—

1. *define analgesic;*
2. *discuss the function of pain in the body;*
3. *identify the different types of over-the-counter analgesics and their components; and*
4. *discuss analgesic dosage forms.*

TERMS AND DEFINITIONS

analgesics—medications that relieve pain
antipyretic—agent that reduces fever
hepatotoxin—a poison specific to liver cells
inflammation—condition caused by injury to body tissue, resulting in pain, swelling, redness, heat, and impaired movement
placebo—inactive substance given as medication to satisfy a patient or as a testing control

As a pharmacy worker, you will often be requested to help people select pain relievers. *Analgesics* are medicines that relieve pain. Some analgesics also reduce fever and inflammation.

PAIN IN THE BODY

Pain is usually associated with disease or injury. It also can be influenced by other factors, including fatigue, anxiety, fear, and anticipation of more pain. Pain may vary in intensity from mild discomfort to intolerable agony. Pain functions in the body as a protective mechanism. In most cases, whatever is causing the pain is harmful to the body, and the pain makes the body try to protect itself.

Pain may have a real physical origin, or it may originate in the mind. *Organic pain* results from a functional or pathological disturbance somewhere in the body. Most of the people who come to the pharmacist for nonprescription analgesics have organic pain. *Psychogenic pain* has no apparent organic cause. It occurs in the absence of any discernible physical disorders.

Psychogenic pain is associated with a phenomenon known as the *placebo effect.* A placebo is an inactive substance given to a patient who thinks the substance is a real drug. Some studies of pain relievers have indicated that 35 to 40 percent of patients who received placebos reported their pain "satisfactorily relieved."

HEADACHES

The most common type of pain is headache. Headaches can take several forms. *Tension headache* is the result of spasms and tightness experienced in the head and neck region. These conditions result from interactions among people and factors in the environment. The pressures of stress are illustrated in figure 1.

Sinus headache is different from other headaches in that it is usually restricted to the frontal areas of the head and behind or around the eyes. Sinus headaches are usually intensified when the patient bends over.

Migraine headache is characterized by intense, throbbing pain, lasting from several hours to one or more days. The pain is often preceded by visual disturbances and numbness and tingling in the lips and face or hands. It is often accompanied by nausea and vomiting.

Fig. 1. The pressures from stress can result in tension headaches.

ASPIRIN—THE MOST POPULAR ANALGESIC

Aspirin, also called by its chemical name, acetylsalicylic acid, is the most often used nonprescription analgesic. About $300 million was spent in pharmacies on aspirin and aspirin-containing products during one recent year. One or two 5-grain (325 mg) tablets is the usual dosage. The exact mode of action of aspirin is not known, but recent studies indicate that it works by inhibiting prostaglandin synthesis. Prostaglandins are normally occurring chemical that affect many body functions, including the mediation of pain response.

EFFECTS OF ASPIRIN

The primary effects of aspirin are as follows.

Analgesic effect. Aspirin relieves pain centrally by acting on the hypothalamus in the brain and peripherally by inhibiting pain impulse production in pain receptors.

Antipyretic effect. Aspirin reduces elevated body temperature or fever. The dose required to reduce fever is considered to be 65 mg per year of age, up to a maximum of 650 mg. It should not be given any more often than every 4 hours. The peak activity of the drug usually occurs within 2 to 3 hours.

Anti-inflammatory effect. Aspirin is effective in reducing inflammation. Its effectiveness in treating rheumatic fever and rheumatoid arthritis is well established. Aspirin is the treatment of choice for arthritis. Aspirin is given in a dosage range of from 4 to 6 grams per day (12 to 18 tablets) in divided doses (that is, not at once).

Aspirin has a number of side effects (as described below) that are important to keep in mind when considering its use.

Allergic reactions. Hypersensitivity to aspirin is characterized by any of these symptoms: shortness of breath, skin rash and edema, hives, severe asthma attacks, bronchoconstriction, and shock. Aspirin hypersensitivity occurs most often in persons who have a history of asthma or chronic hives. An estimated 0.2 to 0.9 percent of the general population is hypersensitive to aspirin.

Gastric disturbances. Indigestion, upset stomach, nausea, and/or vomiting occur in about 5 percent of patients taking aspirin. Gastrointestinal bleeding also occurs with a GI blood loss in the range of 2 to 6 ml per day, and as much as 10 ml lost per day has been reported for some patients.

Ringing in the ears. Ringing in the ears, hearing loss, and vertigo (dizziness) are symptoms of an overdosage. The patient should immediately discontinue the medication and consult a physician.

Interference with blood coagulation. Aspirin inhibits platelet aggregation, thereby interfering with blood coagulation. Salicylates reduce plasma prothrombin (a chemical needed for normal clotting) levels by interfering with the utilization of vitamin K. This vitamin is necessary for the normal synthesis of prothrombin.

ASPIRIN AND SALICYLATE TOXICITY

Aspirin ingestion is one of the leading single causes of accidental poisoning in children under five. With the onset of childproof containers, these poisonings have decreased dramatically.

Limiting baby aspirin products to only 36 tablets per bottle has also helped cut down on accidental poisonings. Symptoms of severe salicylate poisoning include hyperventilation, dimness of vision, mental confusion, delirium, hallucinations, convulsions, and coma.

The purpose of emergency treatment for aspirin poisoning is to delay drug absorption and to remove any unabsorbed drug from the stomach. If the person is conscious and able to swallow, one or two glasses of milk should be given to dilute the drug and slow its absorption. Because of the rapid absorption of salicylates from the gastrointestinal tract, emptying the stomach is advised if the poisoning is detected soon after ingestion. Syrup of ipecac as an emetic is recommended. An emetic dose of syrup of ipecac is 1 tablespoon or 15 cc followed by half a glass of water. If vomiting has not occurred in 30 minutes, the process should be repeated. Do not give fluids to persons who are not completely conscious or convulsing, however. They might vomit, then inhale the vomitus and suffocate.

OTHER NONPRESCRIPTION ANALGESICS

Acetaminophen and salicylamide are two ingredients other than aspirin in nonprescription analgesic products.

Acetaminophen. Acetaminophen has the primary effects of reducing fever and relieving pain. The analgesic and antipyretic effects are equal to those of aspirin. The recommended adult dose of acetaminophen is 325 to 650 mg every 4 hours, not to exceed 3,900 mg in 24 hours. How acetaminophen relieves pain has not been definitely established. It reduces fever by acting on the hypothalamus, possibly, like aspirin, by inhibiting prostaglandin synthesis. Acetaminophen has minimal anti-inflammatory action.

The toxic effects of high doses of acetaminophen are primarily on the liver (hepatotoxicity). A single dose of 10 to 15 grams is seriously hepatotoxic. Emergency first aid for acetaminophen poisoning should include the use of syrup of ipecac to induce vomiting.

Acetaminophen has several advantages over aspirin: (1) it is stable in liquid preparations; (2) there is no cross-allergy with salicylates; (3) there is no dyspepsia or gastric bleeding; and (4) it is the OTC analgesic of choice for people taking gout medications, because it doesn't work against the gout medicine as aspirin can.

Acetaminophen also has disadvantages when compared with aspirin. It lacks anti-inflammatory effects, and it is usually much more expensive than aspirin.

Salicylamide. Salicylamide has been shown to have greater analgesic effects in animals than aspirin. Studies in humans, however, have shown that salicylamide has no superiority over aspirin in doses below 600 mg. It has been shown to have the same effect as a placebo. The FDA OTC Panel on Internal Analgesics, Antipyretic, and Antirheumatic Products concluded that salicylamide is "ineffective in the currently recommended doses of 300 to 600 mg."

ANALGESIC DOSAGE FORMS

When people come to the pharmacy for nonprescription analgesics, the primary choices are aspirin and acetaminophen. Knowing the customer's needs and the product's advantages and disadvantages will enable you to help them select the appropriate medication. You will also be able to help them choose among a variety of dosage forms.

Brand-name aspirin versus generic aspirin. Brand-name aspirin and U.S.P. or generic aspirin both contain between 95 and 105 percent of the labeled amount of aspirin per tablet. Despite the highly advertised claims of manufacturers of brand-name aspirin, studies have shown that the least expensive products have the same analgesic effect.

Buffered aspirin. Buffered aspirin is advertised as producing less gastrointestinal distress although it still has the other side effects of aspirin. In 1971, the Panel on Drugs for Relief of Pain of the National Academy of Sciences–National Research Council reported that most studies showed "little difference in the incidence or intensity of subjective gastrointestinal side effects after ingestion of buffered aspirin or plain aspirin." Examples of buffered aspirin include Bufferin, Arthritis Strength Bufferin (more aspirin and more antacid), Ascriptin and Ascriptin AD (the Ascriptin AD has more antacid than Ascriptin), Cama, Cope, Pabirin, and Vanquish.

Highly buffered aspirin solutions. Products such as Alka-Seltzer and Bromo-Seltzer generally cause less gastrointestinal erosion. They also contain large amounts of sodium and should not be used by people on low-sodium diets. Aspirin is absorbed more rapidly from solution than from either buffered or nonbuffered tablets.

Enteric-coated aspirin. To prevent the gastric distress associated with the dissolution of aspirin in the stomach, enteric-coated aspirin (e.g., Ectrin and A.S.A. Enseals) is formulated to dissolve in the more alkaline small intestine. Absorption from enteric-coated aspirin, however, is erratic. The variable absorption may be caused by premature dissolution in the stomach, or by the variable time spent in the stomach.

Timed-release aspirin. Aspirin can be packaged in capsules to prolong its action. Timed-release aspirin (Bayer Timed-Release Aspirin, Cama, etc.) is designed for people, such as those with arthritis, who need a long-acting medication. These products are not intended for the relief of acute pain, because their absorption is delayed.

Aspirin suppositories. Aspirin is also packaged in suppository form for patients who are unable to take medication by mouth for some reason.

EXTRA-STRENGTH DRUGS

In 1980, extra-strength and capsule analgesic formulations were introduced. Manufacturers added more aspirin or acetaminophen to a single dose to give the "extra strength" to relieve pain. For example, a Tylenol Regular Strength tablet has 325 mg of acetaminophen, while an Extra-Strength Tylenol tablet or capsule has 500 mg of acetaminophen.

Some manufacturers have put their extra-strength products into bright, glossy capsules instead of compressing them into small, dull tablets. Why did the manufacturers encapsulate the powder? First, capsules are easier for some patients to swallow. Second, capsules may be more easily identified with prescription medications, giving them an extra air of potency. Consumers should be aware that capsules are much more expensive to manufacture than tablets and that they will have to pay for the bright, glossy capsule. The increased prices may keep some shoppers from buying them. Extra-strength products can be found in tablets as well as capsules. Some of the product forms of aspirin are illustrated in figure 2.

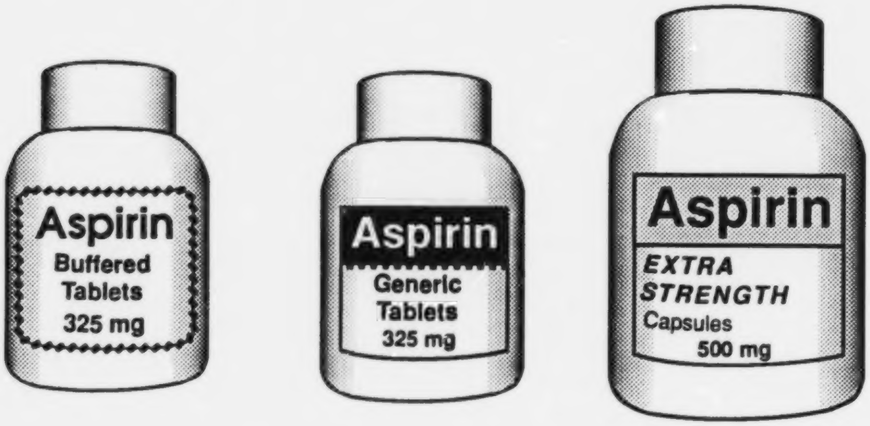

Fig. 2. Aspirin is available in many forms.

SELECTING AN ANALGESIC

The consumer should consider several factors before buying an analgesic product:

- What is the nature of the illness? Is the pain accom-panied by fever and inflammation?
- Does the patient have a history of asthma, hypersensitivity reactions, peptic ulcer, clotting disorders, or gout?
  - Is the patient taking other prescription or nonprescription medication?
  - What is the effectiveness, formulation, and price of the product?

Finally, if the odor of vinegar (acetic acid) is noted, the product should not be purchased. The odor of vinegar tells you the aspirin has decomposed into salicylic acid and acetic acid (although the product will still have some analgesic activity). A person should not necessarily buy the largest bottle of aspirin. It is not economical to purchase the largest bottle of aspirin if it will sit in the medicine cabinet and decompose.

SUMMARY

Analgesics are medications that relieve pain. Pain can be organic or psychogenic. Aspirin is the most often used nonprescription analgesic. Other nonprescription analgesics are acetaminophen and salicylamide. Aspirin products may be buffered, enteric-coated, timed-release capsules, suppositories, or extra-strength.

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Allergy, Cough, and Cold Products

Objectives: After completing this unit, you will be able to—

1. *tell what causes the common cold;*
2. *list the symptoms of the common cold and many common allergies;*
3. *discuss the treatments for the symptoms of colds and allergies; and*
4. *discuss ingredients in over-the-counter products for colds and allergies.*

TERMS AND DEFINITIONS

antihistamine—a drug to block the action of histamine at the histamine-receptor sites

congestion—occurs when an excessive amount of mucous secretion or blood accumulates in body tissues

decongestant—an agent that reduces swelling, especially in nasal passages

demulcent—soothing agent

expectoration—the expulsion of mucous or phlegm from the throat or lungs

lozenge—small disk of dry medication held in the mouth until it dissolves

pharyngitis—inflammation of the pharynx; sore throat

rhinorrhea—runny nose

rhinovirus—virus that affects the upper respiratory system

Allergy, cough, and cold products probably make up the largest segment of the over-the-counter medication market in this country. They also comprise the most variable part of the market, since allergies and colds, flu, and other coldlike illnesses are seasonal. The cold season peaks several times each year—once in the autumn, again in midwinter, and again in the spring.

Although there is no way to cure a cold or quicken its course, Americans spend more than $650 million in pharmacies and $350 million in other stores on allergy and cold remedies in one year alone. These products do not cure, but they can bring temporary relief to the allergy or cold sufferer while the condition runs its course.

Allergies can also be treated in other ways, and serious allergies should receive a doctor's attention. Many common allergies, however, have the same symptoms as a cold. This unit will discuss allergy and cold symptoms that people seek to relieve with the same types of medications.

ETIOLOGY OF THE COMMON COLD

The common cold is an acute viral infection of the upper respiratory tract. At least 120 different viral strains that cause colds have been isolated. The rhinoviruses account for more than half of all the common colds in adults. The *rhinovirus* is a virus that affects the upper respiratory system. The symptoms of acute rhinitis involve the nose, throat, larynx (voice box), and bronchi (breathing tubes of the lungs).

Viral invasion of the respiratory epithelium results in cell injury or death and activates the body's defense mechanism. The resulting pathologic changes of inflammation and edema in respiratory membranes are the symptoms of the cold.

The common cold has been rated as the most expensive single illness in the United States. More time is lost from work and school because of the common cold than from all other diseases combined. Children from the ages of one to five are the most susceptible to colds.

Colds are spread from person to person via droplets produced by sneezing or coughing.

SYMPTOMS OF THE COMMON COLD

The symptoms of the common cold include rhinorrhea, nasal congestion, sneezing, pharyngitis, cough, fever, headache, and malaise.

Rhinorrhea is a profuse, thin, watery discharge from the mucous membranes of the nose, or a runny nose.

Nasal congestion is commonly associated with acute rhinitis and is caused by inflammation of the nasal mucous membranes and increased mucous secretion.

Sneezing is a reflex action to expel air forcibly through the nose and mouth by spasmodic contraction of muscles of expiration due to irritation of the nasal mucosa.

Pharyngitis is inflammation of the pharynx, which connects the mouth, nasal passages, and the esophagus. It is usually associated with dryness or soreness of the throat.

Cough associated with the common cold can be one of three types:

- Congested/productive cough is associated with the expectoration of phlegm.
- Congested/nonproductive cough is associated with chest congestion and scant expectoration of phlegm.
- Dry/nonproductive cough is associated with no chest congestion or expectoration of phlegm.

Fever is elevation of body temperature above 98.6°F (see fig. 1).

Headache is a diffuse pain in the head.

Malaise (the "blahs") is an indefinite feeling of discomfort, weakness, or lack of health. It often indicates the onset of an illness.

TREATMENT

Remember, when considering treatment, that the common cold is a viral infection for which there is no cure, not a bacterial infection that can be treated with antibiotics. The purpose of self-medication is to relieve the symptoms while the cold runs its normal course. In an otherwise healthy individual, the symptoms will usually last 5 to 7 days. Medications have been designed to give some relief in four areas.

Fig. 1. Fever is a symptom of the common cold.

Nasal congestion and nasal discharge. Nasal decongestants (topical or systemic) are vasoconstrictors that help decrease edema and swelling of nasal mucosa.

Cough. Adequate fluids should be provided to the respiratory tract either by drinking more liquids or by humidifying the air with a vaporizer or humidifier. A cough suppressant may be used. An expectorant may be needed to help remove phlegm. A demulcent (soothing agent) may be necessary to help relieve the tickling sensation in the throat.

Dry or sore throat. The symptoms of dry or sore throat, especially in children, should be evaluated by a physician. Common treatments include hard (sour) candy, warm saltwater gargle, and lozenges or sprays containing local anesthetics.

Fever, headache, malaise. The treatment of these symptoms includes analgesics, plenty of fluid, and rest. If fever persists more than 24 hours, a physician should be consulted.

AGENTS IN OTC PRODUCTS

The primary pharmacological agents used to treat allergy, cough, and cold symptoms are antihistamines, decongestants, expectorants, and antitussives.

Antihistamines. Histamine is a normal chemical found in every body tissue. It is localized and stored in granules and usually becomes active only when the cells are damaged. In the common cold and allergic rhinitis, histamine causes vasodilation and edema, especially in the nasal passages.

Antihistamines exert their effort in the body primarily by blocking the actions of histamine at histamine receptor sites. Some side effects of antihistamines are drowsiness, dry mouth, constipation, and blurred vision.

Some antihistamines and some of their trade-name formulations are listed below:

- Chlorpheniramine maleate (Chlor-Trimeton, Teldrin)
- Diphenhydramine hydrochloride (Benadryl)
- Phenyltoloxamine citrate (found in combination in Percogesic and Sinutab)
- Pyrilamine maleate (found in combination in Miles Nervine)
- Pheniramine maleate (found in combination in Triaminic preparations)
- Brompheniramine maleate (Dimetane)

Decongestants. The decongestants differ from each other mainly in duration of action. They are contained in many prescription, as well as nonprescription, products. In recent years, several prescription decongestants have proven to be safe enough to be moved to over-the-counter status.

Nasal decongestants act by constricting dilated arterioles and capillaries in the swollen nasal passages. This shrinks the edematous mucous membranes, which increases drainage and improves breathing. The shrinking of the mucous membranes also helps the sinus cavities to drain. It is extremely important that the patient follow the directions on the label as to duration and frequency of use.

The proper administration of *topical decongestants* (sprays, drops, or inhalants) is essential. Most commercial spray bottles are designed to deliver a dose with one squeeze. Atomizers and inhalers are not designed in such a manner, so care must be taken not to use too much. The best way to administer nasal drops is to lie on a bed or sofa with the head tilted back over the edge. The drops should then be instilled into each nostril without touching the nasal surface with the dropper. The patient should remain in that position for about 5 minutes. The medication should not be swallowed, to avoid absorption and possible systemic effects. This technique is illustrated in unit 10, figure 2A.

Using too much nasal spray or drops too often can result in a condition called *nasal rebound* (rhinitis medicamentosa). The nasal mucous membranes become even more congested as the effects of the decongestant wear off. The longer-acting sprays warn the user not to exceed the recommended dosage "because symptoms may occur such as burning, stinging, sneezing, or increase of nasal discharge." They also warn against using the product for more than 3 days.

Some decongestant products are these:

- Phenylephrine hydrochloride (Neo-Synephrine)
- Naphazoline hydrochloride (Privine)
- Oxymetazoline hydrochloride (Afrin, Duration, Vicks Sinex Long-Acting)
- Xylometazoline hydrochloride (Neo-Synephrine II, Otrivin, Sinutab Long-Lasting, 4-Way Long Acting)
- Levodesoxyephedrine and propylhexedrine (Benzedrex, Vicks Inhalers)

Oral decongestants are usually longer acting than topical decongestants. Oral decongestants also cause a less intense vasoconstriction of the nasal mucosa. The oral decongestant drugs are not associated with nasal rebound.

Oral administration of decongestants, however, exposes patients to systemic side effects. In doses large enough to bring about nasal decongestion, oral decogestants affect other vascular beds in the body besides the nasal mucosa. People with hypertension may experience a change in their blood pressure. Diabetics may see a change in their blood glucose levels. Patients who are predisposed to cardiac arrhythmias (abnormal heart rhythm) and angina (ischemic heart disease) may have cardiac stimulation.

Oral decongestant labels warn people with high blood pressure, heart disease, diabetes, thyroid disease, high fever, or glaucoma to use the product only as directed by a physician.

Some of the oral decongestants are these:

- Phenylephrine (in combination in numerous products)
- Phenylpropanolamine (Coricidin, Allerest, Contac, Dimetapp, and diet aid products)
- Pseudoephedrine (Sudafed, Afrinol, Chlor-Trimeton Decongestant)

Expectorants. The action of an expectorant causes the expulsion of mucus or phlegm from the throat or lungs. The use of expectorants in clinical practice, however, is somewhat controversial. The controversy is due to the lack of objective experimentation showing that expectorants are more effective than placebos. Expectorant usage is based mainly on tradition. The most common adverse effect from expectorants is gastric upset, which is usually minor. Expectorants are used today in almost all cough preparations.

Some expectorants are these:

- Guaifenesin (Robitussin, 2-G, Dimacol)
- Ammonium chloride (Chlor-Trimeton Expectorant, Quelidrine, Triaminicol)
- Ipecac (Cerose, Creomulsion, Quelidrine)
  (Note: Ipecac is not recommended for children under six without a physician's approval.)

Other ingredients are used as expectorants in cough and cold preparations, although their effectiveness remains unproved. Some of them are beechwood creosote, benzoin preparations, camphor, eucalyptus oil, menthol, peppermint oil, pine tar, sodium citrate, tolu, and turpentine oil.

Antitussives or cough suppressants. An *antitussive* is an agent that prevents or inhibits coughing. Antitussive agents work on the central nervous system by depressing the medullary centers in the brain to suppress the cough. They also affect the peripheral nervous system by suppressing the nerve receptors within the respiratory tract itself. Suppressing a productive cough (a cough that produces phlegm) with an antitussive should not be recommended.

The most common antitussive agents in over-the-counter and prescription drugs include codeine, dextromethorphan, and diphenhydramine. In Texas, products containing codeine can be legally obtained by prescription only. In many states, however, you can buy products with codeine by signing a narcotic register in the pharmacy. Dextromethorphan is the most commonly used cough suppressant in over-the-counter products. Diphenhydramine is a potent antihistamine that is also safe and effective as a cough suppressant.

Some cough suppressant products are these:

- Codeine phosphate (Robitussin—AC, Cheracol, Novahistine DH)
- Dextromethorphan hydrobromide (Robitussin—DM, Nyquil, Romilar)
- Diphenhydramine (Benylin, Benadryl)

SORE THROAT OR PHARYNGITIS

Another symptom of the common cold that may require treatment is sore throat or pharyngitis. Pharyngitis usually is either a bacterial infection or the result of continuous postnasal drip on the pharynx. It may also be a symptom of streptococcal throat infection scarlet fever, influenza, smallpox, measles, and tonsillitis. A physician should be consulted if the sore throat persists for more than 2 or 3 days.

If the sore throat can be self-medicated, there are many nonprescription products available to give some relief. Effective local anesthetics are included in lozenges, sprays, gargles, and mouthwashes. Some local anesthetics are benzocaine (5 to 20% concentration), phenol and phenol-containing salts (0.5 to 1.5% concentrations), and benzyl alcohol (in as much as 10% concentrations). Hard candies and lozenges also help to soothe sore throat.

Another treatment of sore throat that may benefit is warm saline gargle. This may be prepared by mixing 2 teaspoonfuls of salt (sodium chloride) in a quart of warm water. This saline gargle may be used as needed for the sore throat.

SELECTING A REMEDY

The great diversity of allergy, cough, and cold preparations on the market gives people a wide range of choices. It allows them to select a product with a combination of ingredients that will relieve only the symptoms they actually have. Knowing the products in your pharmacy will enable you to help people evaluate their symptoms and avoid the "shotgun" remedy by selecting the medication that is appropriate for the kind of allergy or cold they have.

Remember that when cold, cough, and allergy symptoms persist more than 5 to 7 days, the patient should be advised to see a physician (see fig. 2). In a healthy person, most allergies and the common cold are self-limiting conditions. In 7 to 10 days, the patient should be on the road to recovery, with or without treatment.

SUMMARY

Many common allergies have the same symptoms as a cold. These symptoms include runny nose, nasal congestion, sneezing, sore throat, cough, fever, headache, and a general feeling of discomfort. The primary agents used in treatment of colds and allergies are antihistamines, decongestants, and antitussives. The wide range of nonprescription drugs available in a pharmacy allows the customer/patient to select a combination of ingredients that will relieve their special symptoms.

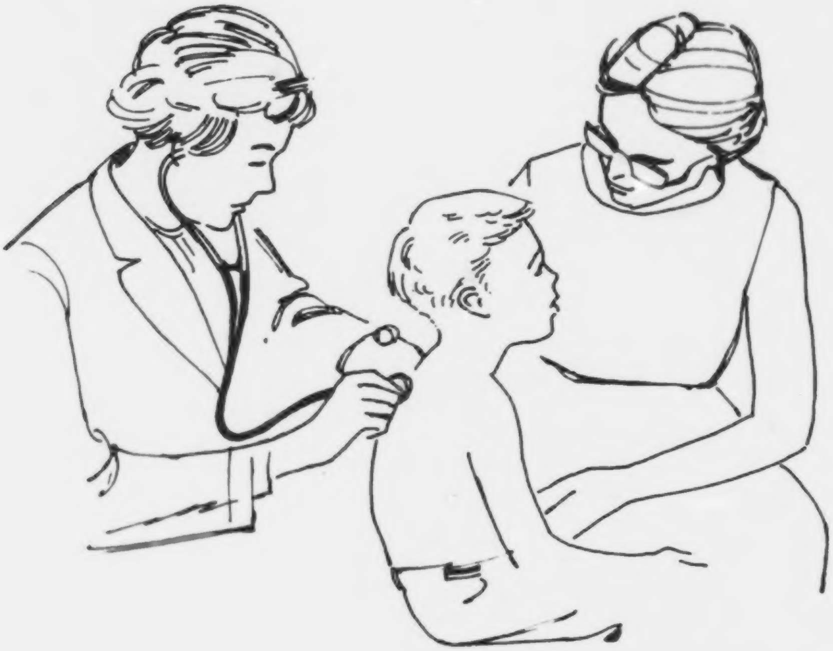


Fig. 2. If cold symptoms persist more than 5 to 7 days, the patient should see a physician.

21

Nutritional Supplements, Vitamins, and Minerals

Objectives: After completing this unit, you will be able to—

1. *discuss the role of vitamins in nutrition;*
2. *name the fat-soluble vitamins and a function of each one;*
3. *name the water-soluble vitamins and a function of each one; and*
4. *discuss the role of minerals in nutrition.*

TERMS AND DEFINITIONS

coenzyme—a substance that combines with an enzyme to activate it

hypervitaminosis—an excess of vitamins in the body

megadose—a very large dose

minerals—inorganic substances essential for the formation, growth, and regulation of the body and its functions

Recommended Daily Allowance (RDA)—the amount of each vitamin, mineral, or other food component essential for good nutrition each day

trace elements—minerals found in very small amounts in body tissues and foods

vitamins—organic substances essential for metabolism, development, and growth of the body

Dietary supplements are not a substitute for food. They should be used only as adjuncts to a well-rounded diet. Consumers should be cautioned about fad diets and about megadose vitamin therapy. There is no significant clinical evidence to show that megadoses of vitamins ensure good health. Nevertheless, health-conscious consumers spend a billion dollars on vitamins and minerals in pharmacies as well as supermarkets and health food stores in one year.

VITAMINS

Vitamins are organic substances essential to the body for the metabolism of other nutrients, such as proteins, carbohydrates, and fats. They also participate in the formation of blood cells, genetic material, hormones, and nervous system chemicals. During these processes, vitamins act as aids to enzymes in the body's chemical reactions.

Vitamins are effective in very small quantities obtained from a well-balanced diet. However, a deficiency can result in malnutrition and certain specific diseases. Vitamin deficiencies can be corrected easily if they are diagnosed early enough.

Some life circumstances may increase a person's need for certain vitamins beyond the ordinary amounts. For example, heavy smokers need additional vitamin C. Users of oral contraceptives need extra B vitamins (thiamine, niacin, pyridoxine, and B-12). Heavy drinking depletes the body's supply of thiamin, niacin, pyridoxine, and folic acid. Elderly people tend to absorb less of the B vitamins and vitamin C and may need supplemental amounts. The prolonged use of antibiotics can destroy the intestinal bacteria that normally produce some vitamins. Pregnancy and nursing a baby increase a person's need for certain vitamins beyond the ordinary amount.

TYPES OF VITAMINS

There are ten essential vitamins. Most of them must be obtained from plant and animal sources because they are not formed in the human body. There are three exceptions: vitamin A is formed in the body from a substance called carotene; vitamin D is formed by the action of sunlight on the skin; and vitamin K is formed by bacteria in the intestines.

Six of the ten essential vitamins are water-soluble, and four are fat-soluble. The B vitamins and vitamin C are water-soluble. The body has no storage mechanism for the water-soluble vitamins, and they are constantly being washed out with urine and perspiration. They should be consumed daily to replenish the body's supply. Large amounts of the water-soluble vitamins are also lost during food processing, preparation, and storage.

TABLE 1
Recommended Daily Allowances

Vitamin	*RDA (adult)*
A	5,000 IU
D	400 IU
E	12 to 15 IU
K	2 to 5 mg
C	60 mg
B_1 thiamine	1.5 mg
B_2 riboflavin	1.2 to 1.7 mg
B_3 niacin, nicotinic acid	12 to 20 mg
B_6 pyridoxine	1.8 to 2.2 mg
B_{12} cyanocobalamin	3 to 6 mcg
folic acid	400 mcg
Mineral	*RDA (adult)*
iron	1.8 mg
calcium	1.0 g
copper	2.0 mg
iodine	150 mcg
magnesium	400 mg
phosphorus	1.0 g
potassium	not established
zinc	15 mg

The fat-soluble vitamins (A, D, E, and K) are consumed in the same manner as foods that contain fat. The fat-soluble vitamins are absorbed in the intestines with the aid of the bile produced by the liver. They are stored in the fatty deposits of the body and do not have to be consumed daily.

The amount of each vitamin required to maintain health has been established by the Food and Nutrition Board of the National Academy of Sciences–National Research Council (see table 1). This amount is referred to as the Recommended Daily Allowance (RDA). The RDAs are not absolute nutritional standards for an ideal diet. They were not designed to meet the special requirements of sick people. Your individual RDA depends on your age, activity level, sex, body size, and physical condition, as well as environmental factors.

THE FAT-SOLUBLE VITAMINS

Vitamin A helps in the formation and maintenance of healthy eyes, skin, hair, teeth, gums, and various glands. It is also necessary for new cell growth and healthy tissue. The natural sources of vitamin A include whole milk and other dairy products, eggs, liver, and leafy green vegetables.

The first symptoms of vitamin A deficiency are night blindness and drying of the conjunctiva. Vitamin A is necessary in pregnant women to prevent malformation of the fetus. The active forms of vitamin A are called retinol and vitamin A_2, or 3-dehydroretinol. Retinol is the most common naturally occurring form. Vitamin A is stored mainly in the liver.

Because fat-soluble vitamins are stored in the body, it is possible to build up an excess of them (hypervitaminosis), which can be harmful. The symptoms of hypervitaminosis due to vitamin A include malaise, lethargy, abdominal upset, bone and joint pain, throbbing headaches, and insomnia.

The use of vitamin A orally for treating acne has shown little clinical evidence of effectiveness.

However, a topical product that contains retinoic acid has shown some effectiveness in the treatment of mild to moderately severe acne.

Vitamin D is essential for normal bone growth and maintenance of strong bones. Vitamin D assists the body to properly utilize calcium and phosphates. The natural sources of vitamin D include milk, egg yolk, liver, tuna, salmon, and cod liver oil.

Vitamin D is the name for several structurally similar chemicals. The chemicals are ergocalciferol (D_2), dihydrotachysterol (D_1), and cholecalciferol (D_3). Vitamin D is needed to stimulate calcium absorption from the small intestine. Vitamin D is synthesized by the skin when it is exposed to the ultraviolet rays of sunlight.

Vitamin D deficiency is reflected in calcium abnormalities. Rickets in children (retarded growth, bowed legs, malformed teeth, and protruding abdomen) and osteomalacia in adults (bone wasting) can indicate vitamin D deficiency.

The symptoms of hypervitaminosis due to excessive amounts of vitamin D include loss of appetite, nausea and weakness, hypertension, kidney failure, anemia, and constipation.

Vitamin E is essential for the formation of red blood cells, muscle, and other tissue. Vitamin E also prevents oxidation of vitamin A and fats. The natural sources of vitamin E include vegetable oils, margarine, whole-grain cereal and bread, wheat germ, liver, dried beans, and green leafy vegetables.

Vitamin E has several forms, of which d-alpha tocopherol is the active form. Vitamin E has been controversial during the last few years because of the many claims for its therapeutic effects. It is claimed to have beneficial effects on the nerves, muscles, and the circulatory system, and also to increase fertility. Some of these effects have been seen in animals, but they have not been shown to be beneficial in humans.

The average American diet will adequately protect against vitamin E deficiency. People should not attempt to self-treat a symptom such as chest pain with vitamin E, because it will only delay proper medical treatment. Vitamin E in large doses has shown little apparent toxicity.

Vitamin K is essential in human metabolism for its function in the blood-clotting system. It aids in the synthesis of prothrombin and other clotting factors in the liver. Green leafy vegetables, tomatoes, cauliflower, egg yolk, soybean oil, and liver of all kinds are good natural sources. Certain gastrointestinal bacteria also synthesize vitamin K in humans. Vitamins K_1 and K_2 occur naturally and are fat-soluble.

Several synthetic compounds have been developed that exert vitamin K activity. These compounds are available by prescription only. There are no OTC products that contain vitamin K. The two products available by prescription are menadione (fat-soluble) and menadione sodium bisulfite (water-soluble). Vitamin K deficiency (hypoprothrombinemia) causes defective coagulation of the blood.

THE WATER-SOLUBLE VITAMINS

Vitamin C (ascorbic acid) is essential in the maintenance of healthy bones, teeth, and blood vessels. Vitamin C is also necessary for the formation of collagen, which supports body structure. It also acts as an antioxidant. The natural sources of vitamin C include many fruits and vegetables (e.g., tomatoes, strawberries, melons, green peppers, potatoes, dark green vegetables, oranges, and grapefruit).

Vitamin C deficiency usually results from a diet lacking in fresh fruits and vegetables. Deficiency can cause a specific disease called scurvy, although scurvy occurs rarely today in the United States because only 10 mg of vitamin C per day is necessary to prevent it. Scurvy can develop, however, from poor nutrition due to psychiatric illness, alcoholism, gastrointestinal disease, food fads, or ignorance. It is characterized by abnormal bleeding and abnormal formation of bones and teeth.

Other symptoms of vitamin C deficiency include impairment of wound healing, reopening of old wounds, loss of appetite, and weakness. Vitamin C is sometimes administered before tonsillectomies. It is also used for treating bleeding gums and in people who bruise easily.

Much has been written on the use of vitamin C in the treatment of the common cold. Doses ranging from 1 to 15 grams per day have been recommended to prevent and treat the common cold. The question of the efficacy of vitamin C in the prevention and treatment of the common cold has been reviewed by the Department of Drugs of the American Medical Association. Their final report indicates that there is "little convincing evidence to support claims of clinically important efficacy."

The symptoms of hypervitaminosis due to extremely large doses (megadoses) of vitamin C include increased danger of urinary stones, diarrhea, and false readings in urinary sugar tests.

The B vitamins include vitamin B_1 (thiamine), vitamin B_2 (riboflavin), niacin (nicotinic acid), vitamin B_6 (pyridoxine), and vitamin B_{12} (cyanocobalamin).

Vitamin B_1 (thiamine) assists in the release of energy to cells from carbohydrates, proteins, and fats. Vitamin B_1 is also necessary for the maintenance of mucous membranes and the synthesis of nerve-regulating substances. Natural sources of vitamin B_1 include liver, pork (especially ham), oysters, whole-grain and enriched cereals, pasta, bread, wheat germ, brewer's yeast, and green peas.

Thiamine is a coenzyme that is necessary for several biochemical reactions in humans. Many of these reactions are important in providing energy. Thiamine-deficiency disease is called beriberi and is most common in the United States in chronic alcoholics. Beriberi ocurs in the Orient, the Philippines, and other islands of the Pacific, and it formerly occurred in the rice-growing regions of the United States.

The symptoms of thiamine deficiency include cardiovascular and neurological abnormalities.

Hypervitaminosis with thiamine is rare. Thiamine's toxicity is also relatively mild. Symptoms noted after parenteral administration of large doses include itching, tingling, and pain.

Vitamin B_2 (riboflavin) is necessary for the release of energy to cells from carbohydrates, proteins, and fats. Riboflavin is also necessary for the maintenance of mucous membranes. The natural sources of riboflavin include liver, milk, meat, dark green vegetables, whole-grain and enriched cereals, pasta, bread, and mushrooms.

Riboflavin, like thiamine, is essential in a number of cellular reactions. Cell growth cannot occur without riboflavin. There seems to be an increased need for riboflavin during periods of increased cell growth (e.g., during pregnancy and wound healing).

Deficiency of riboflavin leads to lip lesions and possibly seborrheic dermatitis. A generalized skin abnormality and sensitivity to light may also occur. The signs of riboflavin deficiency may indicate other more serious conditions.

Niacin (nicotinic acid, B_3) works with thiamine and riboflavin in energy-producing reactions in cells. The natural sources of niacin include liver, poultry, meat, tuna, whole-grain and enriched cereals, pasta, bread, nuts, dried beans, and peas.

Niacin is also a constituent of a coenzyme that is responsible for electron transfer. Electron transfer agents accept or donate hydrogen in the respiratory mechanism of all body cells.

The deficiency disease resulting from a lack of niacin is called pellagra. Pellagra is a rare disease occurring primarily in alcoholics, the elderly, and individuals on exotic diets. Symptoms of pellagra include a rash, diarrhea, thickening of the skin over the face in certain areas, and inflammation of the small intestine. Nausea, vomiting, and central nervous system abnormalities are also characteristic of pellagra.

Niacin is used in patients with peripheral vascular disease, because it causes peripheral vascular dilation. Niacin in high doses has also been used to lower the amount of fats in the blood.

Vitamin B_6 (pyridoxine) is necessary for the absorption and metabolism of proteins and fats. Vitamin B_6 is also necessary for the formation of red blood cells and the proper functioning of the nervous system. The natural sources of pyridoxine include whole-grain cereals, bread, liver, avocados, spinach, green beans, and bananas.

The average American diet provides the recommended daily allowance of pyridoxine. Fad diets don't always contain the RDA of pyridoxine. The symptoms of pyridoxine deficiency are the same as for niacin and riboflavin deficiencies. A deficiency in infants can also lead to convulsive disorders and irritability.

Vitamin B_{12} (cyanocobalamin) and folic acid (below) are involved in many cell activities. Vitamin B_{12} is also involved in fat and carbohydrate metabolism. The rare deficiency is usually due to malabsorption of the vitamin. Cyanocobalamin is well conserved by the body through the liver recycling systems. Some people lack "intrinsic factor," a protein that increases absorption of vitamin B_{12}. They develop a condition known as pernicious anemia. In pernicious anemia, the number of circulating red blood cells, the amount of hemoglobin, or both are reduced. The symptoms include weakness, sore tongue, tingling, and numbness in the extremities. It also causes gastrointestinal symptoms such as diarrhea, nausea, and vomiting. Treatment of this condition usually includes intramuscular injections of vitamin B_{12}. It must be injected since there will be no absorption from the gastrointestinal tract due to the lack of intrinsic factor.

Folic aid (folacin) assists in forming body proteins and generic material and also in the formation of hemoglobin. The natural sources of folic acid include liver, kidneys, dark green leafy vegetables, wheat germ, and brewer's yeast.

The function of folic acid is closely related to that of vitamin B_{12}. Folic acid requirements are directly related to the body's metabolic rate and to cell turnover. The cause of folic acid deficiency is malabsorption. The symptoms of deficiency of folic acid include anemia with large red blood cells (macrocytic anemia), smooth tongue, and diarrhea.

There are several vitamins for which RDAs have not yet been established and deficiencies of which have not been induced or discovered in humans or animals. Several are listed below.

Pantothenic acid is a precursor to Coenzyme A, a product active in many biological reactions in the body.

Biotin is one of the B-complex vitamins. It is widely distributed in animal tissue, and it appears necessary for the formation of protein from amino acids.

Bioflavonoids have been used to treat vascular bleeding. However, there seems to be no clinically established use for the agents. Bioflavonoids are developed from citrus rinds.

MINERALS

Minerals are inorganic substances essential for the formation, growth, and regulation of the body and its parts. The necessary amounts of iron, calcium, and the trace elements are supplied by the normal diets of most people in this country. Most multivitamin and mineral formulations, however, include the following minerals.

Iron (ferrous sulfate, ferrous succinate, ferrous lactate, ferrous fumarate, ferrous gluconate) is essential in the production of healthy red blood cells. A female of menstrual age will require about double the amount required by an adult male. Iron is necessary to prevent iron-deficiency anemia. The natural sources of iron include liver, egg yolk, meat, whole grain cereals, and green leafy vegetables.

Calcium helps in the formation and repair of bones and teeth. It helps regulate certain body processes such as normal nerve behavior, muscle tone, and blood clotting. The natural sources of calcium include milk and milk products, green leafy vegetables, citrus fruits, dried peas, and beans.

Copper is involved in the storage and release of iron to form hemoglobin for red blood cells. Copper is also necessary to maintain proper blood cell production. The natural sources of copper include liver, meat, fish, nuts, and legumes.

Iodine is essential to the normal functioning of the thyroid gland in its production of hormones involved in metabolism regulation. Sources of iodine include vegetables, seafood, and iodized salt.

Magnesium is important for strong bones, teeth, and soft tissues. The natural sources of magnesium include green vegetables, seeds, nuts, whole grains, milk, and egg yolk.

Phosphorus is needed with calcium to build and maintain bones and teeth. It helps to release energy and to contract the muscles. The natural sources of phosphorus include meat, egg yolk, cereals, breads, dairy products, peas, and beans.

Potassium is needed with sodium to maintain proper electrolyte balance and body fluids. Potassium helps with the functioning of the nervous, cardiovascular, and muscular systems. The natural sources of potassium include fish, meat, fowl, fruits, cereal, bananas, and vegetables.

Zinc helps with skeletal growth and the repair of tissue. The natural sources of zinc include meat, seafood, egg yolk, and whole grain.

SUMMARY

The essential vitamins are listed and discussed as to their functions in the body, sources from food, and the symptoms of deficiencies and hypervitaminosis. The vitamins are grouped into those that are fat soluble and those that are water soluble. Minerals and trace elements are listed together with their sources.

22

Products for the Skin

Objectives: After completing this unit, you will be able to—

1. *describe the symptoms of poison ivy and poison oak dermatitis;*
2. *identify types of treatment for poison ivy and poison oak dermatitis;*
3. *discuss the major types of medications used in products for the treatment of poison oak and poison ivy dermatitis;*
4. *identify the three severity levels of burns;*
5. *list techniques for the treatment of both major and minor burns;*
6. *discuss photosensitivity; and*
7. *name the most common agents found in commercial preparations for burns and sunburn.*

TERMS AND DEFINITIONS

astringent—an agent that has a constricting or binding effect
burn—an injury to tissue resulting from overexposure to thermal, chemical, electrical, or radioactive agents
cryotherapy—the therapeutic use of cold
dermatitis—inflammation of the skin
erythema—redness of the skin
photosensitivity—a condition in which the skin reacts abnormally to light
pruritus—itching

POISON IVY DERMATITIS

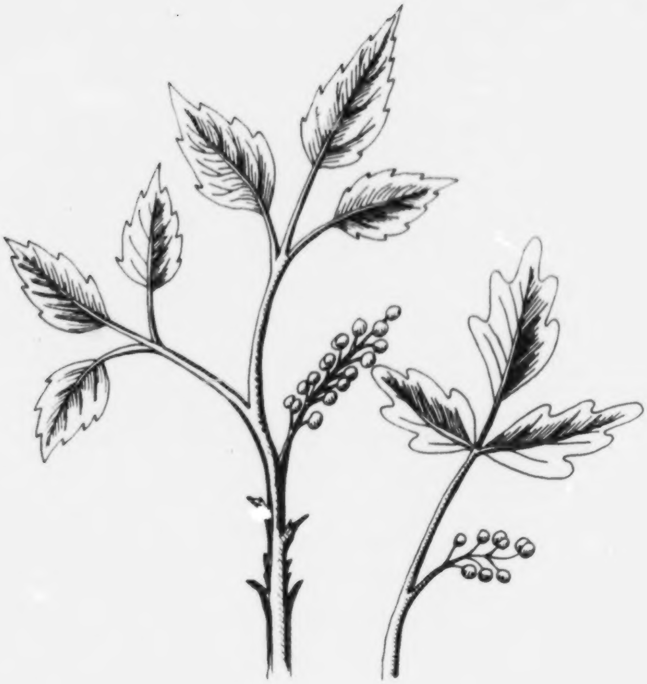
Poison ivy *dermatitis* (inflammation of the skin) is a common allergic reaction to poison ivy, poison oak, or poison sumac. Numerous over-the-counter preparations have been developed over the years for its treatment. The rash may be severe or not, depending on your sensitivity to the allergen. A person with a severe case of dermatitis should consult a physician for treatment.

Poison ivy rash is an allergic contact dermatitis, which is a reaction caused by direct contact with a specific causative agent. The most common sites of contact dermatitis are the exposed parts of the skin, but any part of the skin that comes in contact with the resin may be affected.

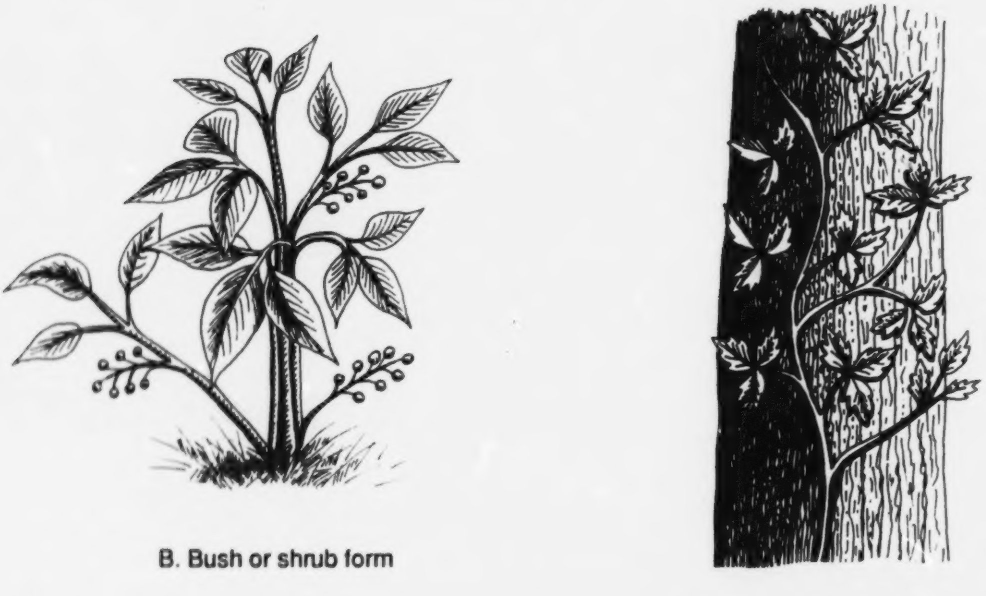
POISON IVY AND POISON OAK PLANTS

Poison ivy and poison oak (Rhus toxicodendron) may be either shrubs or vines and are abundant in the United States. The plants are pictured in figure 1. An estimated 70 percent of the American population will break out if exposed to poison ivy or oak. Although you can get poison ivy dermatitis year-round, the peak season is springtime. Everyone should learn to identify and avoid poison ivy and poison oak. Sensitivity to poison ivy may change over time. It is unwise to assume you have natural immunity even if you have been exposed without reacting in the past. Apparent resistance may be followed by extreme sensitivity on the next exposure. In general, the degree of sensitivity is greatest in childhood and diminishes with age.

Toxicodendrol is the poisonous resin common to poison ivy, oak, and sumac of the Rhus species. Its active ingredient, urushiol, is widespread in the roots, stems, leaves, and fruit of the plant, but not in the flower, pollen, or epidermis of the plant. The poisonous sap



A. Detail of leaves and fruit of poison ivy and poison oak



B. Bush or shrub form

C. Poison ivy climbing on a tree trunk

Fig. 1. Poison ivy and poison oak (Rhus toxicodendron). *The names are used interchangeably. The plant occurs as either a shrub or a vine.*

may reach the skin by direct or indirect contact with the plant.

Touching the bruised or injured plant is likely to cause the worst reaction. You can also be exposed by contact with smoke from the burning plant, by touching contaminated shoes, clothing, or tools, and by stroking an animal that has come into contact with the plant. Washing contaminated objects with soap or detergent will make then harmless.

SYMPTOMS OF DERMATITIS

After initial contact with poison ivy or oak, the resin may be transferred to other parts of the body by the fingers. This makes it appear that the dermatitis is spreading, but that is not the case.

The rash ranges from transient redness to severe swelling, blister formation, and *pruritus* (itching). Blisters and itching are almost always present.

The course of symptoms varies with different people and with the extent of exposure. The skin eruptions usually occur 1 to 2 days after contact with the sap. If the resin is washed off immediately, a simple redness of the skin may last only a few days. In more severe cases, raised lesions appear, followed by blisters. The affected area, often hot and swollen, oozes and eventually dries and crusts. As the inflammation subsides, scaling and some temporary thickening of the skin may occur. Severe untreated contact dermatitis may last two to three weeks or longer if the patient persists in scratching. The affected area is also susceptible to secondary infection.

TREATMENT

The exposed area should be washed with soap and water as soon as possible. The major objectives of treatment include protecting the damaged skin until the acute reaction subsides, preventing scaling and crusting, and relieving the itching.

When the reaction to the poison oak or poison ivy is associated with severe swelling, *systemic treatment* is necessary. Anti-inflammatory prescription-only steroids such as prednisone are commonly administered in severe reactions. The anti-inflammatory steroids are normally given in gradually descending dosages for seven to ten days. Antihistamines (e.g., Benadryl) are also used with limited success.

Local treatment is adapted to the stage or severity of the reaction. Astringent, drying medications that may be applied during the acute weeping and oozing stage include aluminum acetate (e.g., Burow's solution), saline solution, sodium bicarbonate solution soaks, and shake lotions containing calamine, zinc oxide, and starch. Creams, ointments, and sprays should not be used during the blistering and oozing phase.

Preventive treatment. People with a history of severe poison ivy sensitivity may wish to lower their sensitivity. They can take a specific antigen (Rhus antigen) either orally or by injection, which will make them less sensitive (hyposensitive) to poison ivy. Intramuscular injection is the most effective method for developing hyposensitization. Hyposensitization by injection is only a temporary reaction, and the original sensitivity will return in about six weeks.

PRODUCT COMPONENTS

Over-the-counter products for poison ivy and poison oak dermatitis contain four major ingredients. These include local anesthetics, antipruritic (anti-itching) ingredients, antiseptics, and astringents.

Local anesthetics may be applied to relieve some of the soreness and itching. Some of the most common are benzocaine (e.g., Americaine, Solarcaine), dibucaine (e.g., Nupercainal), pramoxine, and tetracaine.

Antipruritic agents alleviate itching. Antihistamines, counterirritants (e.g., menthol phenol, camphor), and the topical hydrocortisones relieve itching, and the counterirritants have a mild local anesthetic effect also. They produce a feeling of coolness and reduce the irritation of the contact dermatitis.

Topical hydrocortisones, which come in creams, ointments, and lotions, were introduced to the over-the-counter market in 1980. They are advertised for the relief of everything from dry skin to hemorrhoids. The most popular brands of hydrocortisone preparations include Cortaid, Dermolate, Lanacort, Cortef, and Caldecort.

Antiseptics are intended to prevent secondary infections that may be associated with poison ivy or poison oak reactions. Clinically, their use and effectiveness is questionable. Examples of antiseptic agents used in over-the-counter products include the phenols, alcohols, oxidizing agents, and benzalkonium chloride.

An *astringent* is an agent that has a constricting or binding effect. The action of an astringent aids in removal of the crusting of poison ivy. Examples of astringents are aluminum acetate (e.g., Burow's solution), tannic acid, and zinc, iron, and zirconium oxides.

BURN AND SUNBURN PRODUCTS

As a pharmacy worker, you are very likely to deal with people looking for over-the-counter products for burns and sunburn. You should be able to tell the difference between a minor burn and a major burn. In the case of minor burns, you can help the customer select appropriate over-the-counter products for self-treatment. You should also be able to determine when a person should see a doctor for the treatment of more severe burns.

Burns are common skin wounds, and they usually call for special consideration. About two million burn accidents occur yearly in the United States. About nine thousand of these are fatal. In recent years, the medical profession has developed a much greater understanding of the pathology of burns. The recovery rate from serious burns is much better than it used to be as a result of sophisticated burn management techniques. There are a number of specialized burn centers throughout the United States.

ETIOLOGY OF BURNS

A ***burn*** is an injury to tissue resulting from overexposure to thermal, chemical, electrical, or radioactive agents. Burns typically affect the skin. The skin is the largest organ of the human body. Major burns often are more traumatic than other injuries. Major burns not only destroy skin and muscle tissue, but they also can destroy nerves and blood vessels. Burned tissue is an excellent medium for microorganisms to grow in, making the area very susceptible to infection. Damage to a large area of skin causes drastic loss of body fluids. Shock always follows a severe burn. Shock may be immediate or delayed, and it may be fatal. Severe burns can cripple, disfigure, and kill.

CLASSIFICATION OF BURNS

Burns are classified according to the depth of damage. The classifications include the following.

First-degree burns are superficial, and the damage is limited to the outer layer of the epidermis. The first-degree burn is characterized by reddening of the skin, which is caused by the dilation of small blood vessels. There is no blistering.

Second-degree burns are burns in which the damage extends into the second layer of skin called the dermis. In second-degree burns, fluid escapes from the blood vessels into the outer layer of the skin, causing blistering.

Third-degree burns destroy the entire depth of the skin and some of the tissues below the skin. The tissues may be charred or coagulated.

Only first-degree and small second-degree burns can be safely treated at home.

The more common types of burns are these. A *thermal burn* results from contact with fire, hot objects, or hot fluids. A *chemical burn* is due to the action of a corrosive or irritating chemical such as acids on the skin. An ***electrical burn*** is the result of exposure to electricity. A *radiation burn* results from overexposure to radiant energy as from sunlight or nuclear accidents. A sunburn is the most common type of radiation burn.

SUNBURN

Sunburn is a dermatitis due to overexposure to ultraviolet rays of the sun. Differences in skin pigmentation are the main cause for different reactions to sunlight. Ultraviolet rays can filter through the atmosphere and burn the skin even on lightly overcast days. The sun's reflection off snow, sand, or water increases the possibility of severe sunburn.

The changes in skin color due to overexposure to ultraviolet rays follow a definite sequence. In the first 20 to 30 minutes, the initial redness appears. If you stay in the sun longer, the true sunburn redness, or *erythema*, begins within 2 to 8 hours. Symptoms of the sunburn persist for several days. Symptoms of severe sunburn include pain, swelling, tenderness, and blistering of the skin. Severe sunburn over a large area of the body can produce malaise, nausea, vomiting, chills, and fever. You will burn faster between 10 A.M. and 2 P.M. A really severe case may involve a second- or third-degree burn.

PHOTOSENSITIVITY

In people whose sunburn is more severe than normal for the amount of exposure, the problem may be due to drug-induced photosensitivity. *Photosensitivity* is a condition in which the skin reacts abnormally to light, especially ultraviolet light. The abnormal reaction can be due to the presence of drugs, hormones, or heavy metals in the patient's system.

Drug-induced photosensitivity can produce an acute rash any time from a few minutes to 24 hours or more after sun exposure. The painful edema (swelling) of severe sunburn is usually absent in cases of sunburn due to photosensitivity. The skin eruptions often extend to areas that have had no exposure.

Several classes of drugs and chemicals may cause photosensitivity reactions. A few of the more common are the tetracyclines (e.g., Achromycin, Declomycin, Robitet, Sumycin), hexachlorophene (e.g., pHisoHex), the thiazide diuretics (e.g., Diuril, Hydro-Diuril), and chlorpromazine (Thorazine).

TREATMENT OF BURNS

The first two considerations in the treatment of all burns are controlling the pain and cleanliness. The affected area should be cooled immediately by immersion in cool water. The use of ice or cold water helps alleviate the pain. It also minimizes the swelling and the depth of injury and aids subsequent healing. The therapeutic use of cold is called *cryotherapy*.

Second, asepsis is essential because of the danger of infection in burns.

Minor burns. The treatment of minor burns can include several steps. (1) Immersion of the area in cold water or ice helps alleviate pain and promote healing. (2) Local anesthetics also help alleviate pain. A common local anesthetic is benzocaine. (3) A skin cleanser keeps the area clean and reduces the chance for infection. (4) A topical antibiotic or antimicrobial agent (e.g., Neosporin, Mycitracin, Neopolycin) may be used to try to prevent infection after the area has been cleaned.

Major burns. If there is any question in your mind whether a burn is minor or major, a doctor should be consulted.

Medical treatment of a severe burn can also include immersion of the area in cold water. To be effective, however, this technique should be used very soon after the burn. It may be too late by the time the person gets to the doctor.

One of the first things the physician or nurse will do is to clean the area. If you suspect a severe burn that will require medical treatment, it is best not to apply any medications or home remedies. Just keep the area as cool and clean as possible.

The physician may give fluids, either orally or intravenously. This helps to prevent shock.

The physician will commonly use antibiotics and analgesics to prevent infections and alleviate pain. *Staphylococci*, *Streptococci*, and *Pseudomonas* are common bacterial organisms that will colonize in a burned area.

MEDICATIONS

Benzocaine is a poorly soluble anesthetic. Because of its low solubility, it also has less chance of causing any systemic toxicity. Penetration of benzocaine through intact skin to nerve endings is slow. Benzocaine in concentrations as low as 5 percent produces some anesthesia. The concentration of benzocaine in commercial products ranges from 0.5 percent to 20 percent. Two products containing benzocaine are Americaine and Solarcaine.

Dibucaine has both anesthetic and antipruritic (anti-itching) effects on intact skin. The suggested strengths of dibucaine range from 0.25 percent to 1 percent. Dibucaine is found in the commercial product Nupercainal.

Lidocaine has both anesthetic and antipruritic effects on intact skin. The suggested strength of lidocaine is 1 to 5 percent. Lidocaine is found in the commercial product Xylocaine, available by prescription only.

Butamben picrate has both anesthetic and antipruritic effects on intact skin. The suggested strengths of butamben picrate range from 1 to 2 percent. Butamben picrate is found in the commercial product Butesin Picrate.

Other agents with some anesthetic and antipruritic activity include benzyl alcohol, dimethisoquin hydrochloride, diclonine hydrochloride, pramoxine hydrochloride, and tetracaine hydrochloride.

These topical anesthetics should not be used on more serious burns where there are open wounds. An acute systemic toxicity may develop.

Most over-the-counter burn preparations deliver the local anesthetic in one of three dosage forms. Ointments, because of their usually greasy base, are the least desirable. If the ointment has to be cleaned from the area by the physician or nurse, the process can be quite painful. Sprays and aerosols deliver the medication in the least traumatizing manner, and they also have a cooling effect. The rubbing process of applying a lotion may increase the pain.

SUMMARY

Poison ivy contact dermatitis is a common allergic reaction. The selection of treatment depends on the severity of the reaction. Mild to moderate cases can be treated with over-the-counter products. Most of the nonprescription products afford some relief from the symptoms of poison oak or poison ivy dermatitis. A person with a severe case of the dermatitis should consult a physician for treatment. It is wise to be able to recognize poison ivy, oak, and sumac so you can avoid it in the first place.

The two basic principles in the treatment of burns are to keep the area (1) as cool as possible, and (2) as clean as possible. Many over-the-counter products will alleviate the pain associated with minor burns. If there is any question whether a burn is minor or major, a physician should be consulted.

23

Weight Control Products

Objectives: After completing this unit, you will be able to—

1. *discuss the theories concerning the etiology of obesity;*
2. *discuss the effectiveness of over-the-counter products for controlling weight;*
3. *list ingredients in over-the-counter products used for weight control; and*
4. *name methods other than the use of diet aids for weight control.*

TERMS AND DEFINITIONS

anorectics—medications used for appetite control

endogenous weight—extra weight caused by abnormality within the body

exogenous weight—extra weight caused by excessive food intake

hypothalamus—ventral portion of the brain controlling body metabolism, regulation of temperature, water balance, and hormonal production

obesity—an abnormal amount of fat on the body; 20 to 30 percent over the average

overweight—an abnormal amount of fat on the body; 10 to 15 percent over the average

satiety—feeling full to satisfaction from eating

In the United States, some 80 million people are overweight. Judging by the $311 million spent during one year on diet aids, many of them would like to lose weight. The over-the-counter market for diet aids has increased dramatically in recent years. There are three significant reasons for this increase.

First, in 1979, the government's OTC advisory review panel recognized phenylpropanolamine as being safe and effective in controlling appetite.

Second, the public, physicians, and the FDA are increasingly against the use of amphetamines to control weight. Stringent regulations govern the purchase and sale of amphetamines and other prescription diet aids.

Third, the image of diet aids among consumers has improved. The major manufacturers of diet aids have entered the marketplace with heavy consumer advertising. These campaigns are designed to promote appetite suppressants as safe, easy, and effective ways to lose weight.

Each year consumers spend millions of dollars on diet aids. You need information about these products in the pharmacy. You should also know the difference between obesity and overweight.

TYPES OF OBESITY

Obesity is an abnormal amount of fat on the body. The term is used when persons are from 20 to 30 percent over the average weight for their age, sex, and height. Someone who is 10 to 15 percent over the normal weight is considered *overweight.*

The two general classifications of obesity are *exogenous* (caused by excessive food intake) and *endogenous* (caused by some abnormality within the body). The main factor in the obese or overweight person is a caloric intake greater than the caloric expenditure.

ETIOLOGY OF OBESITY

Nutritionists and others have developed a number of theories concerning the causes of obesity.

The *fat cell theory* states that the number of fat cells is determined in infancy. According to this theory, fat cells remain present in the body throughout life. As a person loses weight, the size of the fat cells decreases but the number of cells remains the same.

The *infantile obesity theory* relates adult obesity to an excessive number of fat cells during infancy. The excess fat cells predispose the person to obesity later in life.

The *adult-onset obesity theory* states that obesity is due to an enlargement of fat cells, rather than to an increased number of fat cells. After puberty, body chemistry changes the distribution and utilization of fat, and obesity is caused by the expansion of existing cells. An overweight child or adolescent may still be more susceptible to obesity as an adult.

The *genetic component theory* suggests that a child who has one obese parent has a 40 percent chance of becoming obese. A child with two obese parents has an 80 percent chance of becoming obese. However, the genetic component theory has not been definitely proven in humans.

The *environmental influence theory* points toward the widespread advertising of food products as a factor in obesity. Advertising on television and elsewhere reminds us of the pleasures of food and eating.

The *psychogenic component of obesity theory* maintains that a psychogenic component is present in 90 percent of the cases of obesity. For many people, eating relieves tension. Compulsive overeating may replace other missing gratifications such as love, attention, or recognition. Eating habits may be formed in childhood by parents demanding that you eat everything on your plate.

All these theories are probably valid to a certain extent. The fact remains, however, that the basic cause of obesity is taking in more calories than you use up in energy.

HEALTH PROBLEMS

Overweight and obese people tend to have more health problems than people of normal weight. They experience an increased incidence of cardiovascular disease. Studies have shown that the frequency of hypertension in overweight patients is twice that of people of normal weight. Studies have also shown that of adult-onset diabetics aged 40 or older, about 85 percent are obese. Their life expectancy is statistically shorter. In fact, one study reports that for each pound of weight above the ideal, the death rate increases by approximately 1 percent.

APPETITE CONTROL

Along with its other functions, the hypothalamus apparently controls the appetite. Centers of both appetite and *satiety* (feeling full to satisfaction after eating) have been located in the hypothalamus. The cerebral cortex area of the brain controls your response to visual and chemical stimuli. This includes your response to the sight, smell, and taste of foods. Obese or overweight persons may respond differently from people of normal weight to the appearance, smell, and taste of food.

You must eliminate 3,500 calories from your diet in order to lose 1 pound of body weight. In other words, you must reduce your caloric intake by 500 calories a day for 7 days to lose 1 pound per week. The self-discipline required to control your intake (fig. 1) makes losing weight a difficult task. Several organizations use group therapy and behavior modification to help their members diet. Two groups that have been extremely successful are TOPS (Take Off Pounds Sensibly) and Weight Watchers.

Medications that are used for appetite control are called *anorectics.* The term anorectic is derived from anorexia, which means the lack or loss of appetite.

NONPRESCRIPTION PRODUCTS

The prescription drugs used to treat obesity have a real effect on the appetite center in the hypothalamus. These drugs are limited, however, by the fact that a tolerance develops to the appetite suppressing activity. This makes long-term use ineffective and undesirable. The amphetamines and related drugs used to suppress appetite are also undesirable because of their po-

Fig. 1. Salad bars let customers make their own salads from choices available.

tential for abuse and dependence. They should only be used under a doctor's strict control along with a controlled diet. Dietary management and personal motivation are essential factors to any weight-loss program.

Someone taking over-the-counter diet aids may lose weight for the first few weeks or even months. However, for sustained weight control, OTC diet aids must be used in conjunction with proper dietary management. The long-term use of diet aids is not recommended. A person who remains overweight or obese after prolonged use of OTC aids should be advised to see a physician.

PRODUCT COMPONENTS

There are four major ingredients in over-the-counter diet aid products.

Phenylpropanolamine (PPA) is currently the most popular ingredient in over-the-counter diet aid products. It is the major ingredient in Dexatrim, Control, Prolamine, Permathene, and Dietac. Phenylpropanolamine is chemically and pharmacologically related to amphetamine. Its action is thought to be on the hypothalamus. The OTC review panel places phenylpropanolamine in Category I, indicating that it is safe and effective in the properly labeled and recommended doses. The Food and Drug Administration set the dosage recommendation at 37.5 mg per dose, up to 75 mg per day.

The side effects of phenylpropanolamine include nervousness, tachycardia (rapid heartbeat), increase in blood pressure, and dizziness. Its use is contraindicated in people who have diabetes, hypertension, hyperthyroidism, and heart disease.

Phenylpropanolamine is also an extremely effective nasal decongestant. It is found in many over-the-counter and prescription medications for nasal congestion. Someone taking one of the diet aids containing phenylpropanolamine and a cold remedy containing the same ingredient could experience severe side effects because of an overdose of the drug.

Benzocaine, a local anesthetic, is used in nonprescription products to produce a numbness in the mouth. The OTC review panel has placed benzocaine in Category I. Benzocaine is used in gums, lozenges, or candy in a dosage range of 3 to 15 mg. These agents are to be consumed just before eating.

There are no severe side effects associated with benzocaine unless the patient has a sensitivity reaction. Ayds is an example of a product containing benzocaine.

Bulk-producing agents induce weight loss by producing a sense of fullness. Examples of bulk-producing agents are methylcellulose and carboxymethylcellulose. The dosage for these agents is 2.4 g per day in divided doses. These products must be followed by a full glass of water after each dose to be effective. The side effect seen most often is diarrhea. Remember that bulk-producing agents are also effective laxatives.

Caffeine is used with some success in combination with phenylpropanolamine. Caffeine is promoted to help overcome the fatigue associated with dieting. The effective dose of caffeine set by the OTC review panel is 100 to 200 mg per dose of phenylpropanolamine. The most common side effect of caffeine is nervousness or jitters, as many coffee drinkers will attest.

OTHER WEIGHT-LOSS METHODS

Glucose. It is believed by some that raising blood glucose levels affects the satiety center of the hypothalamus. The validity of this theory has not been established.

Low-calorie foods. Commercial low-calorie foods are used to replace high-calorie foods in the diet. In 1980, the FDA required that foods labeled low-calorie must contain no more than 40 calories per serving and no more than 0.4 calories per gram. Slight, temporary water loss may accompany the use of these products.

Artificial sweeteners. If a patient consumes large amounts of sugar, artificial sweeteners will probably not result in any significant weight loss. When saccharine is used to replace one teaspoonful of sugar, 15 calories are removed from the dietary intake.

Fad diets. Examples are the grapefruit diet, the liquid protein diet, the Beverly Hills diet, and numerous others. Fad diets may cause temporary weight loss by motivating the patient, but the motivation is usually short-lived. Fad diets are of little value because they don't result in the development of healthy new eating habits. In fact, some can be quite harmful to your health. Deaths have been directly associated with the liquid protein diet.

Dieting. The most successful and effective method of weight loss and control is reducing your intake of calories. The proper use of nonprescription products and a diet of 800 to 1,200 calories a day is often recommended.

Exercise. Exercise can be a very effective method of weight loss, especially in conjunction with a sensible diet (see fig. 2). People should be advised not to exceed their own limitations on any exercise program. They should see a physician before starting a program of vigorous exercise.

The components of any weight-loss program for the average person should include (1) motivation and self-discipline, (2) proper exercise, (3) reduced caloric intake, and (4) OTC diet aids as needed.

SUMMARY

Judging by the amount of money spent on diet aids, many people in the United States are overweight or obese and desire to lose weight. There are many theories as to the cause of obesity. Most people can lose weight through a reduced calorie intake, proper exercise, and diet aids, as needed. Medications used for appetite control are termed anorectics. The four major ingredients of OTC diet products are phenylpropanolamine, benzocaine, caffeine, and bulk-producing agents. Other weight-loss methods may cause temporary weight loss but don't result in the development of healthy new eating habits.

24

Health Care Accessories

Objectives: After completing this unit, you will be able to—
1. *name types of surgical supplies and discuss their use; and*
2. *list health or prescription accessories and discuss their use.*

TERMS AND DEFINITIONS

absorbents—products with the ability to take in moisture
accessories—products that add to the convenience or effectiveness of something
ostomy—an operation in which parts of the intestinal or urinary tract are removed
stoma—an artificial opening created during surgery
truss—a support for a hernia

Pharmacy workers should be familiar with all the stock on the shelves in both the prescription area and the over-the-counter area. A good way to become familiar with all the stock and learn drug and accessory names is to periodically dust all the stock. At the same time, the pharmacy worker can also check to make sure that fresher stock is behind older stock on the shelf. This is so that older stock will be used first, before it can go out of date.

SURGICAL AND FIRST-AID SUPPLIES

Wound dressings. These dressings are sterile gauze compresses of varying meshes and thicknesses. These have the disadvantage of sticking to wound surfaces. Petrolatum-impregnated gauze is used to avoid the sticking problem, although it can still stick and is very difficult to sterilize. Cellulose gauze impregnated with special emulsions has proven to have a very low degree of adherence to all types of wounds. Specialized types of dressings are also employed for special purposes.

Absorbents. *Absorbents* are products with the ability to take in moisture. *Absorbent surgical cotton* is made from raw cotton fiber by a series of processes that remove the natural waxes, impurities, and foreign substances and make the fibers absorbent. Cotton can be obtained in rolls, balls, applicators, and other forms. *Surgical gauze* is an absorbent strong enough for surgical dressings. Gauze is classified according to mesh or the number of threads per square inch. Gauze pads or sponges are folded squares of surgical gauze. Absorbents come in many other specialized forms—dressing combines, laparotomy sponges, sanitary napkins, disposable cleaners, eye pads, nursing pads, and disposable underpads.

Bandages. Bandages hold dressings in place, provide pressure, or provide support. Bandages may be elastic, inelastic, or rigid for purposes of immobilization. Bandages come as common gauze roller bandages, muslin bandage rolls, elastic bandages, triangular bandages, orthopedic bandages, elastic plaster bandages, stockinet bandages, and cast padding.

Adhesive tapes. Surgical adhesive tapes are made in many forms. They vary in the type of backing and in the type of adhesive. Where strength of backing, superior adhesion, and economy are needed, rubber is usually used. Where a strong backing and superior adhesion are not needed, acrylate adhesive materials are used.

Protectives. These are used to cover wet dressings and hot or cold compresses to retain the moisture, heat, or cold. Examples include plastic sheeting, rubber sheeting, and waxed or plastic-coated paper.

HEALTH AND PRESCRIPTION ACCESSORIES

Cushions and supplies for pressure sores. Many different types of cushions are available for a variety of uses. The most important is to protect the patient from bruises and to prevent bedsores. Wheelchairs, for example, should not be used for long periods of time without a seat cushion. Different types of cushions include ring cushions, sheepskin cushions, horseshoe cushions, foam cushions, inflatable ring cushions, silicone gel cushions, water-filled foam cushions, resin-filled foam cushions, and other specialized cushions.

Trusses. Trusses are supports for patients with hernias or ruptures. A hernia is the protrusion of the intestine and its surrounding membrane, the peritoneum, through a natural opening in the abdominal wall, or through the muscles of the abdomen, usually at a previously weakened point. Abdominal and umbilical hernias are very common. In most cases, surgery is the preferred treatment, but some patients require trusses instead of surgery. To properly fit trusses for patients, the fitter should have special training.

Urology and incontinence supplies. Urinals are used to collect urine. Incontinence pants are used when the patient has lost bladder or bowel control. They are made of soft, flexible fabric with a rubber or plastic coating inside. Catheters are used to collect urine from patients who are unable to void naturally or where urinals and incontinence pants are not enough. Rectal tubes are larger catheters intended for rectal use in the removal of feces. Using a catheter can be a dangerous procedure. It is normally handled by physicians, nurses, or orderlies, although some patients are trained to do it themselves, particularly if they don't have to be hospitalized.

Ostomy appliances and supplies. An *ostomy* is an operation in which parts of the intestinal and/or urinary tract are removed. The remaining end or ends are then brought to the abdominal wall, and a stoma (artificial opening) is created surgically through which urine and/or feces will pass. If part of the colon is brought to the abdominal wall, the operation is called a colostomy. If part of the ileum (the small intestine) is involved, the operation is called an ileostomy. These two are probably the most common of the many ostomy procedures.

Ostomies fall into three basic categories, which determine the type of appliance appropriate for each.

1. Ostomies that produce solid waste at the stoma (including most colostomies) require an appliance with a larger gasket opening to accommodate the characteristically larger stoma. These appliances are detachable, throwaway pouches made of thin plastic and sealed at the bottom. They either are worn with an elastic belt or are self-adhesive, no-belt types.
2. Ostomies that produce only urine at the stoma require a permanent appliance that is usually cemented directly to the skin. These appliances are usually made of rubber and have at the bottom a screw-type drain that only needs to be twisted slightly to open for emptying.
3. Ostomies that produce semisolid waste (ileostomies) require an appliance that cements to the skin, like the urinary appliance, or one that uses a karaya-gum washer to give a waterproof seal and is usually worn with an elastic belt. The ileostomy appliance is open at the bottom rather than having a drain, and is closed by folding and securing with a rubber band or clip.

Thermometers. The clinical or fever thermometer is used for recording body temperature. Three bulb types of clinical thermometers are available: (1) the oral type, which is slender and the most sensitive for mouth use; (2) the rectal type, with a blunt, strong, pear-shaped bulb for safety and to ensure retention in the rectum; and (3) the universal type, a small, sturdy thermometer with a short stubby bulb, for oral or rectal use. It is safer to use for babies or difficult patients. Remember that normal rectal temperatures are usually 1°F higher than oral, or 99.6°. Every home should have at least one type of clinical thermometer.

Hospitals and clinics use electronic thermometers. This type of thermometer consists of an electronic machine with a display and a cord with a tip, or probe. The probe has disposable covers called sheathes for one-time use. The temperature is registered on the display almost immediately and with great accuracy. A second probe is available for rectal temperatures. The disposable sheathes save time by eliminating the need to clean and maintain glass thermometers. Digital thermometers are similar but intended for use by individuals. The digital display is located on the probe, which is operated by a battery. Disposable sheathes are used.

Another method for measuring body temperature uses paper treated with chemicals which change color at various body temperatures. The paper is placed on the body, usually the forehead, and the temperature determined by comparing the developed color to a standard. The paper is discarded after one use. This method is convenient for use with babies and small children. Types of thermometers are shown in figure 1.

Inhalers and atomizers. Atomizers reduce liquid medications to a fine spray or aerosol. They and other inhalers are used mostly in the treatment of respiratory tract conditions. The vaporizer, for example, provides hot steam for the relief of upper respiratory illnesses. The room humidifier provides a cool mist to compensate for insufficient moisture in the air.

Hypodermic equipment. Hypodermic syringes are used to administer medication parenterally. Glass syringes are reusable; disposable ones may be made of plastic or other materials. The needles are metal and are classified by their different points and different beveled cutting edges. The usual range of diameter for needles is from 13 gauge (largest) to 29 1/2 gauge (smallest). The usual range of length is from 1/4 to 3 1/2 inches.

A variety of needles are designed for special purposes (biopsies, transfusion, etc.). Few patients other than diabetics will ever use a hypodermic syringe. Because syringes may be used

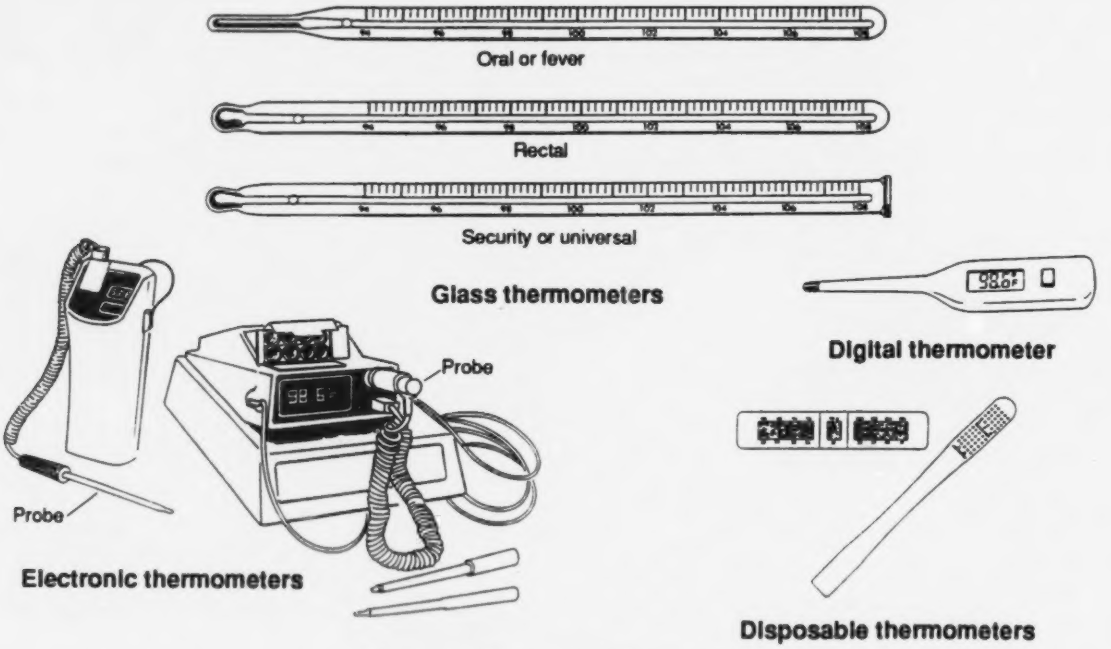


Fig. 1. Various types of thermometers

to administer illegal drugs, it is illegal in some states for nonmedical persons to possess them.

Other syringes. Other types of syringes are stocked in many pharmacies. Plunger syringes, usually made of hard rubber, are used for rectal irrigation, but they can be risky. Bulb syringes are usually preferred today. They come in many sizes depending on the intended use. Smaller bulb syringes are useful in nose and ear irrigation.

Home health care accessories. Some pharmacies also stock other health accessories with which the pharmacy worker should be familiar. These include wheelchairs, walkers, canes and crutches, commodes, hospital beds, traction apparatus, patient lifters, bedpans, special bed tables and trays, and orthopedic supports and braces.

Wheelchairs allow nonambulatory patients to move around their environment safely and efficiently. Wheelchairs come in all sizes, shapes, and styles. A typical wheelchair is shown in figure 2.

A walker is an ambulation device made of tubular metal. There are many types on the market. The standard walker has only three sides and no wheels. The rolling walker has wheels. Refer to figure 3 for examples of walkers.

Canes are usually made of wood or aluminum. These also come in many styles and models. Patients needing extra stability will use a quad cane. Canes are shown in figure 4.

Crutches generally come in two types (fig. 5). *Axillary crutches* are the most common type. Usually made of wood or aluminum, these crutches are used by people needing short-term help. *Canadian or Lofstrand crutches* are used by people needing permanent help with walking. These crutches have a cuff or band that fits around the forearm to keep the crutches in place.

Other types of home health products will vary with the pharmacy. Choosing the appropriate devices for the patient depends on the patient's needs as an individual and what has been prescribed by a doctor or suggested by a therapist. In many instances, equipment plays a major part in the patient's rehabilitation needs.

SUMMARY

Surgical and first-aid supplies include wound dressings, absorbents, bandages, adhesive tapes, and protectives used as coverings. Other accessories are cushions, trusses, incontinence supplies, ostomy appliances, thermometers, inhalers and atomizers, hypodermic equipment, syringes, and home health care products. These products add to the convenience or effectiveness of patient care.

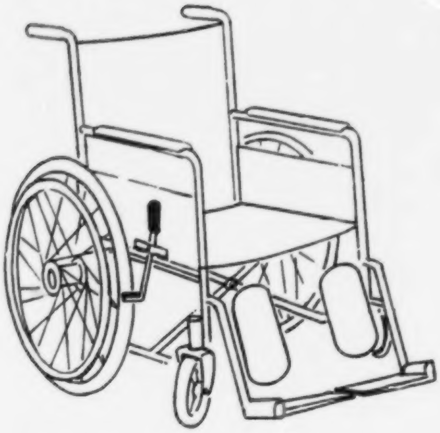


Fig. 2. Wheelchair

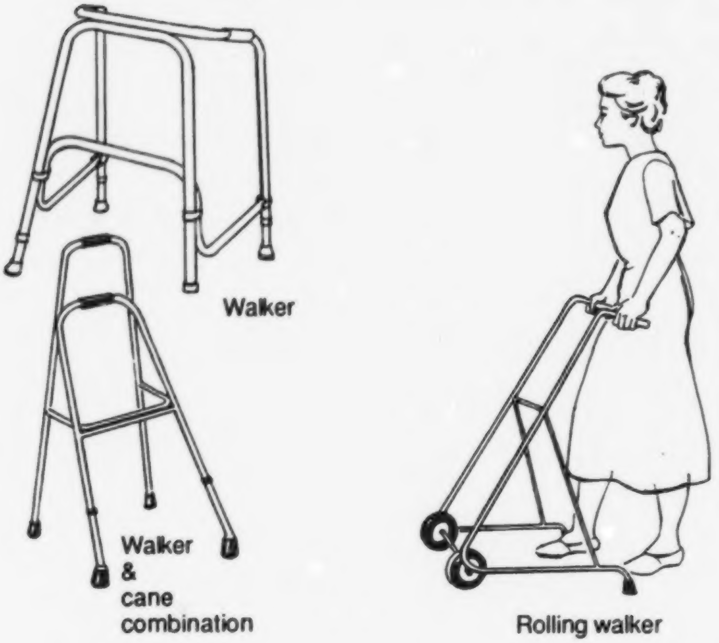

Walker
Walker & cane combination
Rolling walker

Fig. 3. Types of walkers

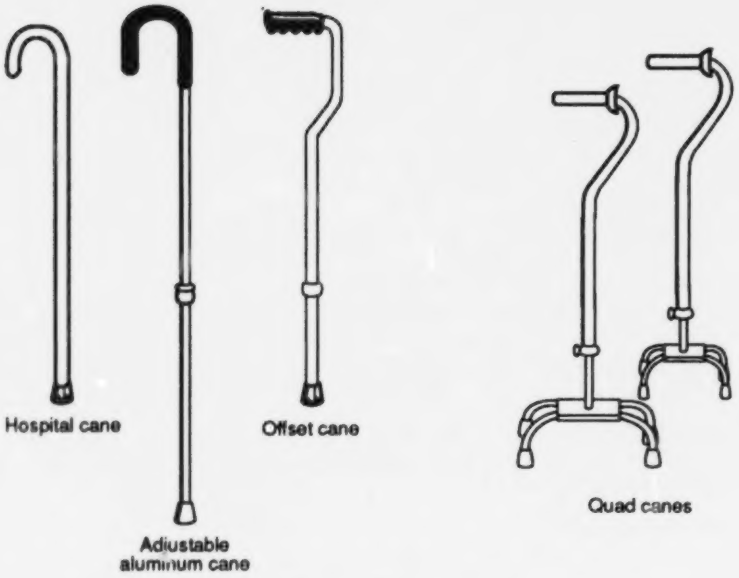
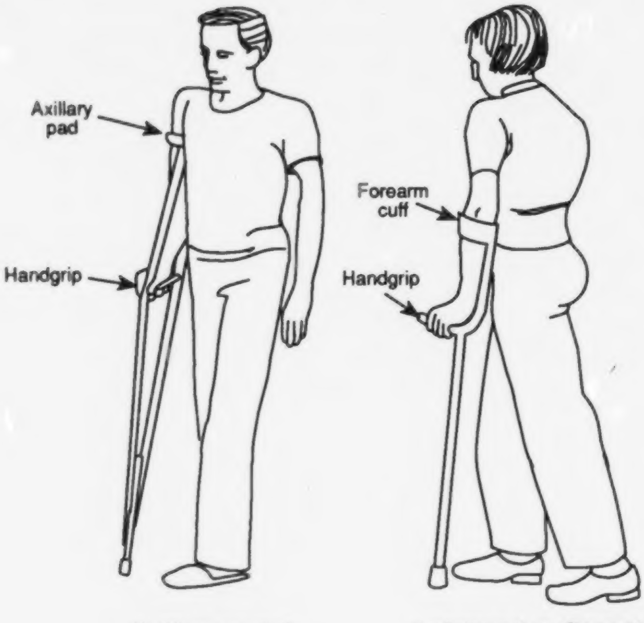

Hospital cane
Adjustable aluminum cane
Offset cane
Quad canes

Fig. 4. Types of canes


Axillary pad
Handgrip
Forearm cuff
Handgrip

Axillary crutch

Lofstrand or Canadian crutch

Fig. 5. Types of crutches

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WORKING IN PHARMACIES

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STUDENT LEARNING ACTIVITIES

Working in Pharmacies

Student Learning Activities

By

Carl W. Driever

and

Larry McClaughterty

Revised by

Helena J. Fair

Published by

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COMPLIANCE STATEMENT

TITLE VI, CIVIL RIGHTS ACT OF 1964; THE MODIFIED COURT ORDER, CIVIL ACTION 5281, FEDERAL DISTRICT COURT, EASTERN DISTRICT OF TEXAS, TYLER DIVISION

Reviews of local education agencies pertaining to compliance with Title VI Civil Rights Act of 1964 and with specific requirements of the Modified Court Order, Civil Action No. 5281, Federal District Court, Eastern District of Texas, Tyler Division are conducted periodically by staff representatives of the Texas Education Agency. These reviews cover at least the following policies and practices:

(1) acceptance policies on student transfers from other school districts;

(2) operation of school bus routes or runs on a non-segregated basis;

(3) nondiscrimination in extracurricular activities and the use of school facilities;

(4) nondiscriminatory practices in the hiring, assigning, promoting, paying, demoting, reassigning, or dismissing of faculty and staff members who work with children;

(5) enrollment and assignment of students without discrimination on the basis of race, color, or national origin;

(6) nondiscriminatory practices relating to the use of a student's first language; and

(7) evidence of published procedures for hearing complaints and grievances.

In addition to conducting reviews, the Texas Education Agency staff representatives check complaints of discrimination made by a citizen or citizens residing in a school district where it is alleged discriminatory practices have occurred or are occurring.

Where a violation of Title VI of the Civil Rights Act is found, the findings are reported to the Office for Civil Rights, Department of Health, Education and Welfare.

If there is a direct violation of the Court Order in Civil Action No. 5281 that cannot be cleared through negotiation, the sanctions required by the Court Order are applied.

TITLE VII, CIVIL RIGHTS ACT OF 1964: EXECUTIVE ORDERS 11246 and 11375; TITLE IX 1973 EDUCATION AMENDMENTS: REHABILITATION ACT OF 1973 AS AMENDED; 1974 AMENDMENTS TO THE WAGE-HOUR LAW EXPANDING THE AGE DISCRIMINATION IN EMPLOYMENT ACT OF 1967; VIETNAM ERA VETERANS READJUSTMENT ASSISTANCE ACT OF 1972 AS AMENDED IN 1974.

It is the policy of the Texas Education Agency to comply fully with the nondiscrimination provisions of all federal and state laws and regulation by assuring that no person shall be excluded from consideration for recruitment, selection, appointment, training, promotion, retention, or any other personnel action, or be denied any benefits or participation in any programs of activities which it operates on the grounds of race, religion, color, national origin, sex, handicap, age, or veteran status (except where age, sex, or handicap constitute a bona fide occupational qualification necessary to proper and efficient administration). The Texas Education Agency makes positive efforts to employ and advance in employment all protected groups.

Learning Activity 1
Word Recognition

UNIT 1
Careers in Pharmacy

Objective: To recognize terms relating to pharmacy (SCANS F01, F02, F08)

Directions: Select the word(s) to complete the following sentences.

1. The word *pharmacy* is derived from the Greek word ______________________________ .

2. The art and science of preparing medications from natural and synthetic sources for use in the treatment and prevention of diseases is ____.

3. During the nineteenth century, the modern profession of pharmacy was fashioned from the work of ________________________ and ________________________.

4. The first pharmacy school founded in the United States was ____________________________
____.

Directions: Match each definition to its proper term by writing a letter in the blank.

_____ 5. study of action and uses of drugs

_____ 6. study of drugs derived from natural sources

_____ 7. science of dispensing medicines

_____ 8. name given in former times to the physician-pharmacist

_____ 9. to be able to practice pharmacy in a state other than the state in which the pharmacist was originally licensed

_____ 10. working with a specific patient in a team of physicians, nurses, pharmacists, and other health professionals

_____ 11. principles and practices of business and law as they apply to pharmacy

_____ 12. application of organic and inorganic chemistry to medications

a. pharmaceutical chemistry

b. pharmacology

c. pharmacy administration

d. pharmaceutics

e. pharmacist

f. apothecary

g. reciprocity

h. toxicology

i. clinical pharmacy

_____ 13. a person responsible for advising people in the use of medications and drugs

_____ 14. person who dispenses drugs and medicines under the direction of a pharmacist

j. pharmacognosy

k. pharmacy technician

Objective: To describe the career opportunities in pharmacy (SCANS C05)

Directions: Write the answers to the following questions.

1. What are the pharmacist's responsibilities in the pharmacy where you are assigned?

2. How many years of education are required to earn a Bachelor of Science in Pharmacy?

3. What body of government regulates pharmacists in a particular state?

4. Name two items an applicant must submit to the state board before licensure is given.

   (1)

   (2)

5. What practical experience is required before licensure?

6. If your license as a pharmacist has been revoked in your state, can you move to another state and begin your career again? Explain your answer.

7. Name the pharmacy schools in Texas.

8. What are the two major career fields for workers in pharmacies?

   (1)

   (2)

9. What are four career opportunities for pharmacists other than these two?

   (1)

   (2)

   (3)

   (4)

10. What factors can motivate workers in both individually owned and chain pharmacies?

11. Cite two differences between the community and hospital pharmacy.

    (1)

    (2)

12. Determine the major obligation of the hospital pharmacist and by what method this obligation is discharged.

13. What is OBRA 90, and what are its requirements?

14. Talk with the pharmacist where you are assigned to determine (a) the name of the college of pharmacy she/he attended, (b) in what state his/her license was issued, and (c) whether other states have issued reciprocal licenses to this person. Write your findings here.

15. List all employees in the pharmacy where you are assigned. Determine and indicate the training and qualifications of each on your list.

Objective: To research the history and the present educational requirements of pharmacy

Directions: These are special projects. They may be selected by the student in consultation with the instructor. (SCANS C13)

1. Write two colleges of pharmacy in your state, and request a catalog to obtain their entry requirements and course offerings. Prepare a chart or write a paper to show differences and similarities in entry requirements and course offerings. Request information on expenses, and determine the approximate cost of one year of study at each college. (SCANS C03)

2. Interview pharmacists from two different areas of pharmacy. Find out why they chose pharmacy as a career and why they chose their area of pharmacy in which to practice. Determine advantages and disadvantages of each area. Talk with your instructor to determine whether to prepare a written or an oral report. (SCANS C04)

3. Develop a list of the most beneficial classes a student wishing to become a pharmacist could take during the junior and senior years at your high school. Suggest classes in which that student should enroll during the first two years of college. Prepare charts to show the classes needed at both levels of education. (SCANS C06)

4. Write two job descriptions—one for a pharmacist working in a community pharmacy and the other for a hospital pharmacist. Include a current salary range for each area. (SCANS C07)

5. Select a topic from those listed below. After research, write a paper on that topic. (SCANS C14)
   a. Pharmacy as It Developed in the United States
   b. Pharmacy and Drugs in Greece and the Roman Empire
   c. Pharmacy and Drugs in Ancient Egypt and Middle Eastern Countries
   d. The Work of the Apothecary

Objective: To describe the role of ethics in the pharmacy (SCANS F01, F02, F08)

Directions: Write the answers to the following questions.

1. What is the common bond that ties pharmacists together?

2. Explain the difference between *laws* and *ethics* in pharmacy.

3. What can exist only if the client has confidence in the pharmacist's adherence to a code of ethics?

4. What must be the foundation of all ethical behavior?

5. Is there a statement of ethics in the hospital or pharmacy where you work? Is it the Code of Ethics from the American Pharmaceutical Association?

6. What are three guidelines to remember for creating a friendly, professional atmosphere in the pharmacy?

   (1)

   (2)

   (3)

7. Describe the proper dress for someone working in a pharmacy.

8. From what type of activities in the pharmacy do pharmacists dissociate themselves?

9. Describe guidelines followed by pharmacists in relations with customers.

10. Choose one word to describe the relationship between pharmacist and patient.

11. What kinds of knowledge can the pharmacist share with the prescription patients?

12. When might certain aspects of a patient's medication best be left up to the physician to discuss with the patient?

13. What public health education programs may the pharmacist participate in?

14. Pharmacists can create goodwill for business by participating in what kinds of non-health-related activities?

15. What two factors make working in pharmacies different from other retail businesses?

    (1)

    (2)

16. What are several things to do to help ease the situation when handling complaints from customers?

Objective: To relate ethics to the local pharmacy

Directions: These projects may be selected or assigned during a conference between teacher and student. (SCANS C13)

1. Compose your own code of ethics for your assigned pharmacy. (SCANS C09)

2. Assume that Mr. Black, a customer, returns to the pharmacy to complain that the pharmacist has filled his prescription incorrectly. The pharmacist has just departed to attend a meeting of his service club. How do you deal with this situation? Write out what you would say and do. (SCANS C13)

3. You begin working at the City Pharmacy. At the end of two months, you have realized that your co-worker Robert is uncooperative, lazy, and frequently short in his answers to customers' questions. You have tried to talk with Robert, but he has not changed. What should you do? Write out the steps you would take, and explain why you took them. (SCANS C09)

4. Write a narrative summary of the Code of Ethics for the American Pharmaceutical Association. (SCANS C07)

Objective: To describe the types and levels of regulations applied to pharmacy (SCANS F01, F02, F08)

Directions: Write answers to the following questions.

1. What is a controlled substance?

2. What is a legend drug?

3. Evaluate the processes of dispensing and distributing. Which is the more complicated? Explain why this is so.

4. Can state laws regulating drugs be less stringent than federal laws? Which would be enforced in that case?

5. What are the two federal agencies involved with pharmacy and drug regulations and their enforcement?

   (1)

   (2)

6. Can the FDA inflict punishment or impose penalties?

7. Can nonpharmacist employees dispense some Schedule V controlled substances without a prescription?

8. Name the two state agencies involved with drug regulations and their enforcement in your state.

   (1)

   (2)

9. Can Schedule I controlled substances be dispensed by any pharmacy provided with a prescription?

10. List the categories of scheduled drugs. Give an example of each category available in the pharmacy to which you are assigned.

11. List the three prescription files that pharmacies in Texas must keep by law.

    (1)

    (2)

    (3)

12. Do hospital inpatient drug records come under state law?

13. Identify the following abbreviations:

    a. DEA

    b. FDA

    c. OTC

    d. DPS

Objective: To become familiar with the agencies and regulations that govern pharmacy (SCANS C15)

Directions: These may be selected by the student or assigned by the teacher, as these are projects requiring more advanced skills. Letters must be approved by the instructor before mailing. Replies must be offered as evidence of completion of the assignment together with a brief summary of the regulations.

Teachers may choose to provide a library copy of these regulations for reference. The student would be required to read and prepare a paper summarizing the regulations, as assigned by the instructor. (SCANS C15)

1. Write to the FDA to obtain a copy of the Food, Drug, and Cosmetic Act with Amendments.
   Address: FDA Regional and District Office
   3032 Bryan Street
   Dallas, TX 75204

2. Write to the DEA for federal regulations pertaining to the Controlled Substances Act of 1970 (Public Law 91-513).
   Address: Drug Enforcement Administration
   U.S. Department of Justice
   Washington, DC 20537

3. Write to the State Board of Pharmacy to obtain current pharmacy regulations for your state.
   Address: Texas Board of Pharmacy
   8505 Cross Park, Suite 110
   Austin, TX 78754-4594

4. Write to the Texas Department of Public Safety for the current state drug laws, including rules relating to the State Controlled Substances Act.
   Address: Texas Department of Public Safety
   5805 N. Lamar Boulevard
   Austin, TX 78752

Objective: To discuss hazards in the pharmacy (SCANS F01, F02, F08)

Directions: Write answers to the following questions.

1. Define these terms.

   a. safety

   b. environmental safety

2. What is the purpose of OSHA?

3. What does the acronym OSHA mean?

4. Under what governmental department does OSHA fall?

5. List six environmental hazards found in the pharmacy.

   (1)

   (2)

   (3)

   (4)

   (5)

   (6)

6. List four procedures for lifting heavy objects.

   (1)

   (2)

   (3)

   (4)

7. Why is cleanliness important in the pharmacy?

8. What is a laminar flow hood? Where would one be found?

9. What is the reason for discarding sharps in a special receptacle?

10. List five general rules to remember about fire safety in the pharmacy.

(1)

(2)

(3)

(4)

(5)

11. List three things to remember in the event of a robbery in your pharmacy.

(1)

(2)

(3)

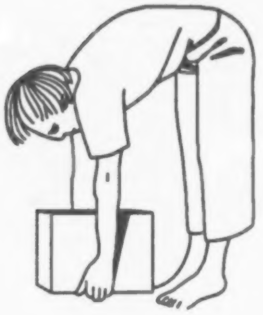
Objective: To apply safety principles in specific situations

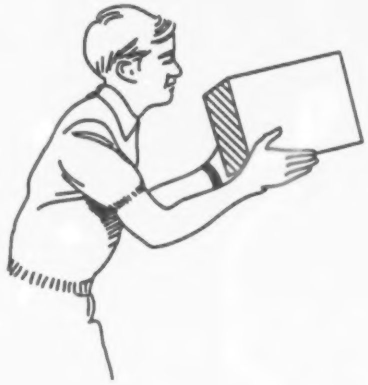
Directions: Read the following statements and write answers for the questions.

1. One Saturday morning the pharmacist calls you at home to ask you to open the pharmacy. He has had car trouble and will be very late getting to work. You arrive and open the pharmacy. As you turn on the lights, you realize that a burglary has occurred, because drug cartons and medications are scattered about. The cash register is open. What should you do? (SCANS C12)

2. In one area, the thief has opened some containers of soft drinks, spilling some of these on the floor. How should you handle this situation? (SCANS C12)

3. Unsafe handling of materials is shown. Below each drawing, write the correct procedure to be used for the situation. (SCANS C16)





Objective: To observe local fire, environmental, and general safety practices

Directions: At a conference between student and instructor, select the number of the following projects for completion. (SCANS C13)

1. Draw a floor plan of your pharmacy, and show all exits and the locations of all fire extinguishers. Suggest ways to improve safety through relocation of exits or extinguishers. (SCANS C03)

2. If your pharmacy has a specific fire plan, briefly describe it. If your pharmacy has no formal fire plan, suggestion one that could be instituted. (SCANS C05)

3. Suggest general policies and procedures to follow in the event of a burglary or robbery. Write these out as guidelines for use by employees. (SCANS C10)

4. Describe any safety hazards that you can find in your pharmacy, and tell how they could be eliminated. (SCANS C05)

5. List equipment requiring cleaning in the pharmacy where you are assigned. Determine the recommended cleaning intervals and how often each actually is cleaned. Evaluate the adequacy of the cleaning techniques and the frequency of cleaning. (SCANS C16)

Objective: To describe procedures for handling new and refill prescriptions (SCANS C15)

Directions: Write answers to the following questions.

1. What is included in dosage?

2. What is a prescription?

3. List the seven parts of a prescription.

   (1)

   (2)

   (3)

   (4)

   (5)

   (6)

   (7)

4. These abbreviations will be found on a prescription. Indicate which of the seven prescription parts these are, and explain what they mean.

   a. Rx

   b. Sig

5. In what portion of the prescription is the generic or trade name of a drug indicated?

6. Is the U.S. customary or the metric system of measurement used in the pharmacy?

7. Explain what is meant by the "errors and omissions" part of the procedure for filling a prescription.

8. What are the five "rights" of medication dispensing?

(1)

(2)

(3)

(4)

(5)

9. Does the law require the pharmacist to hand the medication to the patient?

10. What four information items does the pharmacist need to process a refill?

(1)

(2)

(3)

(4)

11. List the procedures for handling the transfer of a prescription from one pharmacy to another. Be sure to include what information will be needed.

Objective: To recognize abbreviations used in prescriptions (SCANS C15)

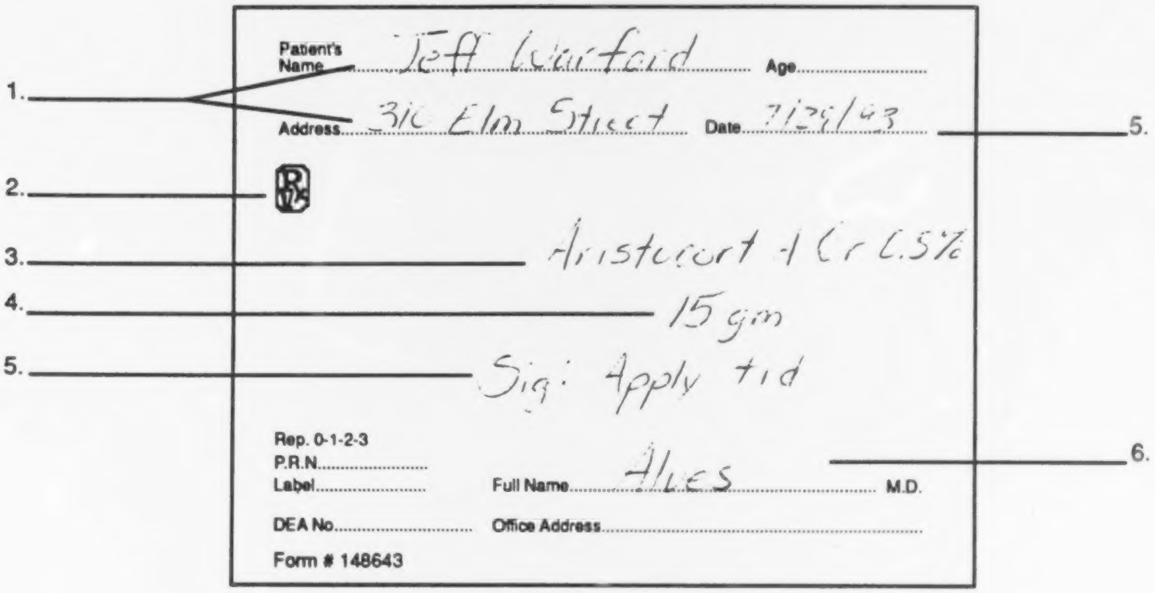
Directions: Match each abbreviation to its term.

_____ 1 Rx
_____ 2. dr
_____ 3. 30 cc
_____ 4. gr
_____ 5. gtt
_____ 6. o.s.
_____ 7. ac
_____ 8. p.r.
_____ 9. p.v.
_____ 10. q.o.d.
_____ 11. t.i.d.
_____ 12. o.u.
_____ 13. stat
_____ 14. ss
_____ 15. aa
_____ 16. O.T.O.
_____ 17. a.s.
_____ 18. N & V
_____ 19. p.c.
_____ 20. prn

a. each
b. rectally
c. vaginally
d. both eyes
e. grain
f. two tablespoonfuls
g. one tablespoonful
h. teaspoon
i. drop
j. left eye
k. three times daily
l. twice daily
m. "take thou"
n. before meals
o. every other day
p. at once
q. one-half
r. as needed
s. after meals
t. gram.
u. once daily
v. one time only
w. left ear
x. nausea and vomiting

Objective: To name the parts of a prescription (SCANS C15)

Directions: A prescription is shown. Label the parts indicated.



Patient's Name Jeff Warford Age

Address 310 Elm Street Date 7/29/93

℞

Aristocort A Cr 0.5%

15 gm

Sig: Apply tid

Rep. 0-1-2-3
P.R.N.
Label
Full Name Alves M.D.

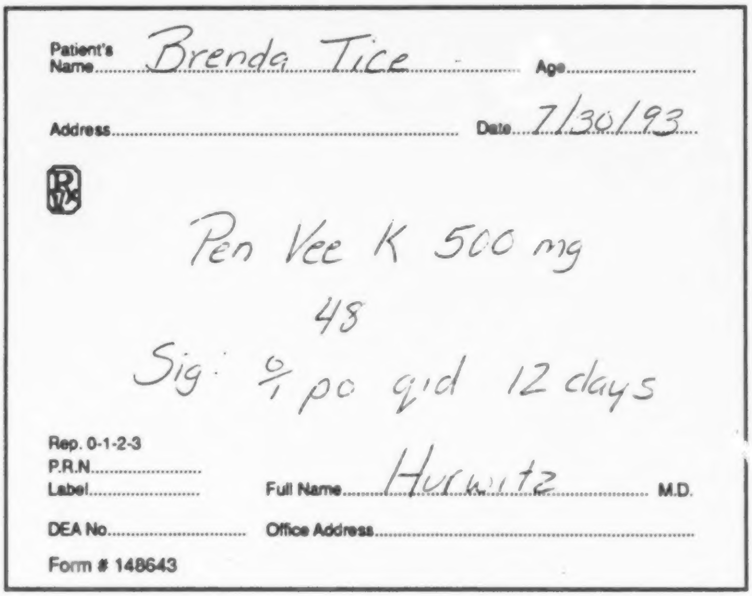
DEA No.
Office Address

Form # 148643

Objective: To identify Latin and other abbreviations as they appear on prescriptions (SCANS C07)

Directions: On a separate piece of paper, write the correct directions as they would appear on a prescription label.

1.



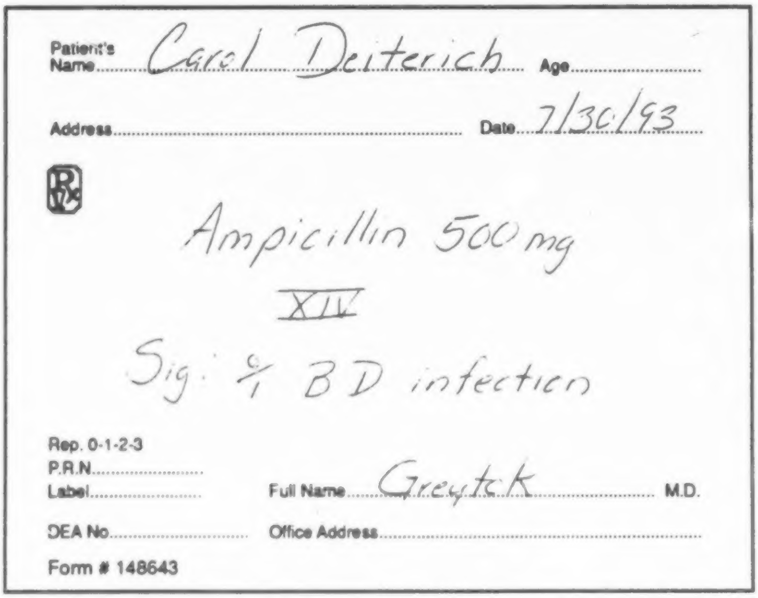
Patient's Name Brenda Tice Age
Address Date 7/30/93

℞

Pen Vee K 500 mg
48
Sig: ī po qid 12 days

Rep. 0-1-2-3
P.R.N.
Label Full Name Hurwitz M.D.
DEA No. Office Address
Form # 148643

2.



Patient's Name Carol Deiterich Age
Address Date 7/30/93

℞

Ampicillin 500 mg
XIV
Sig: ī BD infection

Rep. 0-1-2-3
P.R.N.
Label Full Name Greytck M.D.
DEA No. Office Address
Form # 148643

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3.

Patient's Name Jane Wilson Age

Address Date 7/30/93

℞

Vibramycin 100mg

$\overline{\underline{\text{VI}}}$

Sig: $\dot{\overline{\text{ii}}}$ stat, $\dot{\overline{\text{i}}}$ qd

Rep. 0-1-2-3
P.R.N.
Label Full Name Egerton M.D.
DEA No. Office Address
Form # 148643

4.

Patient's Name Chip Byas Age

Address Date 7/30/93

℞

Donnatal

IV oz

Sig: $\dot{\overline{\text{i}}}$ dr q 4h prn pain or burning

Rep. 0-1-2-3
P.R.N.
Label Full Name Rothenberg M.D.
DEA No. Office Address
Form # 148643

5.

Patient's Name Jackie Barnes Age

Address Date 7/30/93

℞

Monistat - 7

1 tube

Sig: $\dot{\overline{\text{i}}}$ applicatorful pv q hs 7d

Rep. 0-1-2-3
P.R.N.
Label Full Name Falk M.D.
DEA No. Office Address
Form # 148643

Patient's Name Patricia Rawlins Age

Address Date 7/30/93

℞

Librax

C

Sig ut dict

Rep. 0-1-2-3
P.R.N.
Label
Full Name Vandiver M.D.

DEA No. Office Address

6. Form # 148643

Patient's Name Rosemary Hopkins Age

Address Date 7/30/93

℞

Lasix 40mg

xxx

Sig: ī po q.o.d. fluid retention

Rep. 0-1-2-3
P.R.N.
Label
Full Name Conway M.D.

DEA No. Office Address

7. Form # 148643

Patient's Name John Warford Age

Address Date 7/30/93

℞

Neosporin opth. oint.

1/8 oz

Sig: Apply ou qid

Rep. 0-1-2-3
P.R.N.
Label
Full Name Hesse M.D.

DEA No. Office Address

8. Form # 148643

BEST COPY AVAILABLE

Patient's Name Kathy Holm Age

Address Date 7/30/93

℞

Robitussin DAC

120 cc

Sig: ī dr q 3 to 4 h prn cough

Rep. 0-1-2-3

P.R.N.

Label Full Name Smith M.D.

DEA No. Office Address

Form # 148643

9.

Patient's Name Shana Hoffman Age

Address Date 7/30/93

℞

Phenergan pedi

100 ml

Sig: 5 ml po qid cough

Rep. 0-1-2-3

P.R.N.

Label Full Name Hotz M.D.

DEA No. Office Address

Form # 148643

10.

Patient's Name Chad Marshall Age

Address Date 7/30/93

℞

Tigan 100 mg

XII

Sig: ī pr q 4h N & V

Rep. 0-1-2-3

P.R.N.

Label Full Name Hargrove M.D.

DEA No. Office Address

Form # 148643

11.

12.

Patient's Name Bill Pierce Age

Address Date 7/30/93

℞

Aldomet 250 mg

C

Sig. ī qid B.P.

Rep. 0-1-2-3
P.R.N.
Label
Full Name Carpenter M.D.
DEA No.
Office Address
Form # 148643

13.

Patient's Name Lee Rodriquez Age

Address Date 7/30/93

℞

Garamycin ophth drops

10 cc

Sig: ī gtt os qid

Rep. 0-1-2-3
P.R.N.
Label
Full Name Basso M.D.
DEA No.
Office Address
Form # 148643

14.

Patient's Name Carol Heimer Age

Address Date 7/30/93

℞

Isordil 2.5mg SL

100

Sig: ī SL qid SOB.

Rep. 0-1-2-3
P.R.N.
Label
Full Name Chapman M.D.
DEA No.
Office Address
Form # 148643

Objective: To recognize abbreviations on prescriptions used in local pharmacies

Directions: The student may select one or both of these projects as agreed upon with the instructor. (SCANS C13)

1. Prepare a list of twenty abbreviations that are used in the pharmacy, and give their meanings. These must not be included on the list in the unit. (SCANS C06)
2. Prepare a collection of blank prescription forms. The quantity is determined by agreement between student and instructor. Compare these, and discuss in a report the advantages or disadvantages of the various forms. Select the one that seems best to you. Tell why you chose it. (SCANS C05)

Objective: To discuss methods for receiving, storing, and distributing drugs and medications in local hospitals and community pharmacies (SCANS C05)

Directions: Write answers for the following questions.

1. List six questions that a pharmacy worker should keep in mind when checking in a delivery at the pharmacy.

   (1)

   (2)

   (3)

   (4)

   (5)

   (6)

2. Describe three types of alphabetical listings used in pharmacies for drug storage.

   (1)

   (2)

   (3)

3. Fill in the temperature ranges established by the U.S.P. for the following terms.

   a. cold

   b. cool

   c. room temperature

   d. warm

   e. excessive heat

4. Explain what type of lid is found on medication containers sold to customers.

5. What information is required on prepackaged medication labels?

6. Describe the floor stock distribution system in hospitals.

7. What are the disadvantages of an individual prescription drug distribution system in hospitals?

8. Describe the unit dose drug distribution system in hospitals.

9. What is the difference between a centralized hospital pharmacy and a satellite hospital pharmacy?

10. When might a community pharmacy use a unit-dose drug distribution system?

Objective: To use terminology related to packaging of drugs and their containers (SCANS C05)

Directions: Answer the following questions.

1. What is *materials management*?

2. What is a *container*?

3. Why is the presence of the *expiration date* on a container important?

4. Describe two types of packaging.

5. Explain the difference in *deliquescence* and *efflorescence.*

6. Define *evaporation.*

7. Below are listed four types of containers. State what protection each offers when medication is placed inside it.

   a. light-resistant

   b. well-closed container

   c. tight container

   d. hermetic container

8. Differentiate between the terms *single-dose* and *unit-dose.*

9. What is a *multiple-unit container*?

10. What is a *multiple-dose container*?

Objective: To describe local policies in pharmacies for the packaging, storage, and distribution of drugs and medications

Directions: In conference, the student and instructor should select which of these projects the student should complete. (SCANS C13)

1. Determine the procedures your pharmacy uses for ordering drugs and supplies. Outline these procedures in a report. Offer suggestions to improve the process. Determine and list five of the largest suppliers. (SCANS C03)

2. Write out the policies and procedures utilized by your pharmacy regarding prepackaging or repackaging. Be sure to include safety guidelines. (SCANS C03)

3. If you are in a hospital pharmacy, describe the drug distribution system that is used in a report. List any problems that have recently arisen with that system and how these can be corrected. You may design a flowchart, if you prefer, to show the distribution system. (SCANS C17)

4. If you are in a community pharmacy, describe both bulk storage and the way drugs are shelved in the prescription area of the pharmacy. Write out advantages and disadvantages of the way drugs are stored in your pharmacy. Suggest ways to improve storage in both areas. (SCANS C17)

5. If you are in a community pharmacy, determine the average and maximum times that customers must wait to have a prescription filled. Suggest ways to cut the waiting time. (SCANS C16)

6. List the eight types of containers. Locate and list two examples of medications requiring each type of continer. Seek help from your supervisor, if needed, to determine the requirements of any drug or medication. (SCANS C05)

Learning Activity 1
Measurement and Calculation

UNIT 7
Metrology

Objective: To discuss the systems of weights and measures used in pharmacy (SCANS C15)

Directions: Write answers to the following questions.

1. Define metrology.

2. Name the four measurement systems used in pharmacy.

   (1)

   (2)

   (3)

   (4)

3. Which system is preferred?

4. List the accepted abbreviations for the following:

   a. minim

   b. fluid dram

   c. fluid ounce

   d. scruple

   e. dram

   f. ounce (apothecary)

   g. ounce (avoirdupois)

   h. pound (apothecary)

   i. pound (avoirdupois)

   j. pint

   k. gram

   l. meter

   m. liter

   n. kilogram

   o. milligram

5. Cite four methods by which calculations may be recorded.

   (1)

   (2)

   (3)

   (4)

6. Define these terms:

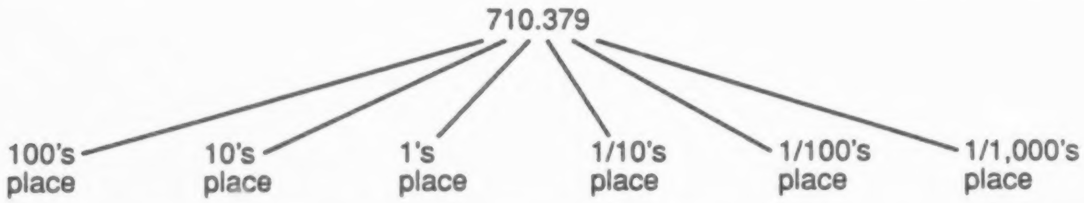
   a. fractions

   b. decimal fractions

   c. ratio

   d. percentage

7. Figure 1 is reproduced below. In the space below the word *place*, write the Greek or Latin prefix applied to the primary unit to indicate that value.


710.379
100's place
10's place
1's place
1/10's place
1/100's place
1/1,000's place

Learning Activity 2
Conversions

UNIT 7
Metrology

Objective: To identify equivalents in the Roman, Arabic, metric, and apothecary systems and to convert to percentages and ratios (SCANS C15)

Directions: Supply the answers to complete the following tables.

1. Fill in the appropriate places.

	Arabic Numeral	*Roman Numeral*
a.	50	________
b.	10	________
c.	________	V
d.	19	________
e.	________	LXXIV
f.	500	________
g.	________	MMI
h.	117	________
i.	________	DLXIV
j.	________	XCIX

2. Fill in the conversion table.
   a. 1 qt = ________ pt
   b. 1 oz (avoir.) = ________ gr
   c. 1 ʒ = ________ ℈
   d. 1 kg = ________ g
   e. 0.01 g = ________ mg
   f. 1 l = ________ ml
   g. 1 ml = ________ l
   h. 1 teaspoonful ≅ ________ ml
   i. 1 m = ________ cm
   j. 1 pt = ________ ml
   k. 1 kg = ________ lb
   l. 1 gr = ________ mg
   m. 1 lb = ________ g

3. Convert these ratios to percentage strengths.
   a. 1:2,000 = ________
   b. 1:10,000 = ________
   c. 2:500 = ________

4. Convert the following to ratio strengths. Do not use decimals.
   a. 7.5% = ________
   b. 0.001% = ________
   c. 2.5% = ________

Objective: To perform calculations in all the systems of weights and measures used in pharmacy (SCANS C15)

Directions: Solve the following problems. Blacken in the circles that correspond to your answers. When you have connected the blackened circles properly, you should see a picture of a mortar and pestle. Good luck!

______ 1. How many 500 mg tablets should be taken by a patient in one day if the prescription reads: i g b.i.d.?

______ 2. How many grains are there in 650 mg?

______ 3. What is the Arabic number for XCIX?

______ 4. How much NaCl (table salt) would you weigh out to make 1 liter of a 0.9% solution?

______ 5. How tall in centimeters is someone who is 5' 9"?

______ 6. An order is received to dispense 240 ml of ampicillin (250 mg/5 ml) suspension. What size bottle in ounces should be used?

______ 7. How many 250 mg tablets are there in a 3 g dose?

______ 8. Consider the following prescription:

Rx

Ampicillin Susp. 250 mg/5 ml

Sig. - 250 mg QID for 10 days

How many ml should be taken by the patient to fulfill the entire regimen?

______ 9. How many cm are in 1.5 m?

______ 10. Eight drams equals how many grains?

______ 11. One ℈ equals how many gr?

______ 12. One pound (avoir.) equals how many ounces (oz)?

______ 13. Write 2/5 as a percentage.

______ 14. Write 75% as a fraction.

______ 15. Write 50% as a fraction.

______ 16. If a dose of a drug is 0.5 mg and a patient mistakenly took 2.5 mg, the patient took how many times too much?

______ 17. How many 10 mg tablets should be dispensed as a one-month (30-day) supply if the directions are: Sig. III q AM

______ 18. Ten dl equals how many ml?

______ 19. A high school science teacher said that 25 percent of his class failed the latest examination. If the class has 76 students, how many failed the exam?

______ 20. Your pharmacy buys a particular ointment in 1-lb quantities. How many g would be left in a 1-lb can if 65 g were used for a prescription?

______ 21. Two tablespoonfuls is approximately how many ml?

______ 22. 5/8 + 1/4 = ?

______ 23. How many mg are in 2.0 gr?

______ 24. If one dose of a drug contains 2.5 mg, how many mg are in 25 doses?

______ 25. How many inches are in 582 cm?

______ 26. LXXI minus XLII equals what Arabic number?

______ 27. One lb equals how many gr?

______ 28. Four gal equals how many pt?

______ 29. Hecto- is a prefix meaning what?

______ 30. How many 2 mg doses are there in 250 mg?

______ 31. If 1 gr of a drug costs $.24, how much would 2 ℈ cost?

______ 32. How many grams of active ingredient are in 150 ml of a 1% solution?

______ 33. How many mg of active drug would be in 500 g of a 1:1,000 mixture?

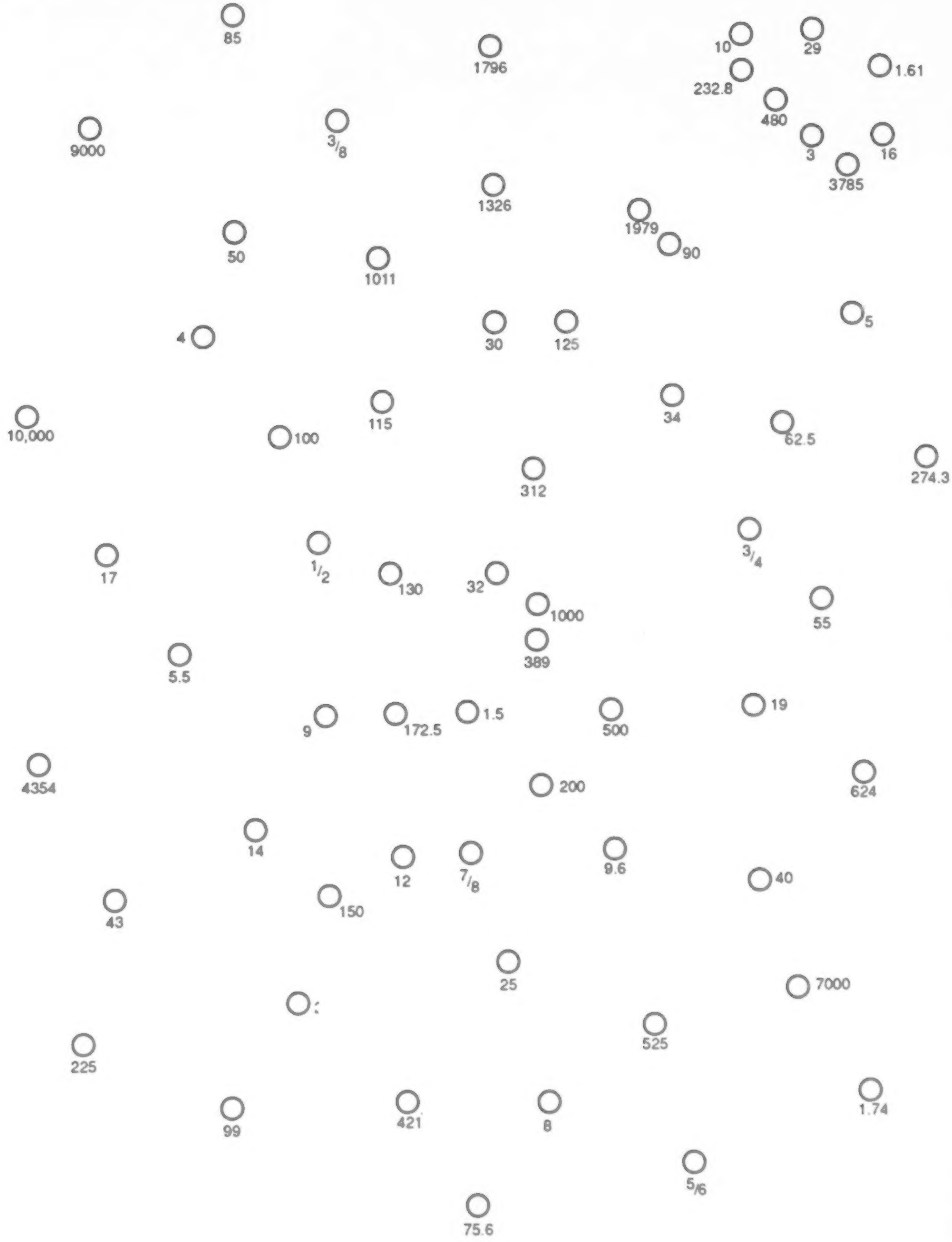
______ 34. If a product sells for the cost price plus 35% of the cost, what would the product sell for if it cost $1.29?

______ 35. How many g are there in 1 kilogram?

______ 36. MCMLXXIX is what in Arabic numbers?

______ 37. One gal equals how many ml?

______ 38. 1 + 2 = ?


85
1796
10
29
1.61
232.8
480
9000
3/8
3
16
3785
1326
1979
90
50
1011
5
4
30
125
10,000
100
115
34
62.5
274.3
312
3/4
17
1/2
130
32
1000
55
5.5
389
9
172.5
1.5
500
19
4354
200
624
14
12
7/8
9.6
40
43
150
25
7000
525
225
1.74
99
421
8
5/6
75.6

Objective: To determine the usage frequency of metric measure and other measuring systems

Directions: During discussion, the student and instructor should determine the number of projects to be completed. (SCANS C13)

1. Prepare a set of flash cards showing values of the apothecary weight and apothecary fluid measure systems. Use these to teach values to another student or to give an oral presentation to your class. (SCANS C10)
2. Survey your home to determine the frequency of metric measure in use in the household. The automobile is included. Prepare a written report, a series of drawings, or a collection of labels and commercial illustrations to present the results of the survey. (SCANS C07)
3. Research and write a report on the history and spread of the metric system around the world. Point out nations that do and do not use metric measure. (SCANS C18)

Learning Activity 1
Characteristics of a Good Employee

UNIT 8
Managing a Pharmacy

Objective: To evaluate oneself as a worker (SCANS F13-F17)

Directions: Many characteristics go into the makeup of a good employee. Some of the qualities a good pharmacy worker might be expected to have are listed below. Rate yourself by circling the appropriate number on the scale. Ask your supervisor to evaluate you on the same scale. Compare evaluations and discuss the differences and similarities.

	Never				Always
1. Initiative					
Are you a self-starter?	1	2	3	4	5
2. Adaptability					
Are you able to adjust to different situations?	1	2	3	4	5
3. Judgment					
Do you make thoughtful, informed decisions?	1	2	3	4	5
4. Cooperativeness					
Are you a team worker?	1	2	3	4	5
Do you get along well with other employees?	1	2	3	4	5
5. Dependability					
Are you at work every day?	1	2	3	4	5
Are you on time?	1	2	3	4	5
6. Creativity					
Do you use good sense in completing tasks?	1	2	3	4	5
Do you use creativity in completing tasks?	1	2	3	4	5
7. Leadership					
Are you a good leader?	1	2	3	4	5
Are you a good follower?	1	2	3	4	5
8. Follow-through					
Do you finish assigned tasks?	1	2	3	4	5
9. Problem-solving ability					
Do you solve problems that arise in an accepted manner?	1	2	3	4	5

Objective: To use terminology relating to management and computers (SCANS F01, F02, F08)

Directions: Circle the letter before the word that best defines the statement. Use "Terms and Definitions" for reference.

1. Sending and receiving messages
   a. management
   b. control
   c. organization
   d. communication

2. The screen used for temporary viewing of data stored in a computer
   a. modem
   b. keyboard
   c. display
   d. interface

3. A device to keep a business running smoothly
   a. control
   b. working capital
   c. inventory
   d. performance

4. Data printed on paper
   a. software
   b. hardware
   c. hard copy
   d. auxiliary equipment

5. A series of activities directed toward achieving certain objectives
   a. orientation
   b. management
   c. communication
   d. control

6. A device to convert electronic signals from one form to another
   a. computer
   b. console
   c. modem
   d. display

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7. Money to carry on day-to-day activities of a business
    a. purchasing
    b. working capital
    c. budget
    d. financial control

8. The place where data is stored in a computer's main unit
    a. window
    b. memory
    c. display
    d. control

9. Area of data viewed on a computer display at one time
    a. window
    b. memory
    c. display
    d. control

10. The performance of clerical procedures by computers
    a. management
    b. control
    c. data processing
    d. communication

Objective: To discuss the functions of management and data processing within the pharmacy (SCANS C08, C12)

Directions: Write answers to the following questions.

1. In your own words, briefly discuss the five functions of management: planning, organizing, directing, communicating, and controlling.

2. What is the purpose of the recruiting process?

3. What is the first step in a good training program?

4. What are two ways of evaluating a worker's performance?

   (1)

   (2)

5. Why is the employee-relations climate in a pharmacy an important part of the overall atmosphere?

6. What is one secret of the successful pharmacy?

7. What is the end purpose of all the functions of a pharmacy's business?

8. List the three basic components of a data processing system.

   (1)

   (2)

   (3)

9. Describe what is meant by hardware.

10. Explain how peripheral devices are used.

11. What device would be used to connect a telephone to a computer?

12. Name three types of computers.

    (1)

    (2)

    (3)

13. Describe the major differences in the three types.

14. Which type of computer does your pharmacy have?

15. Give the meaning of these abbreviations:

    a. CPU

    b. PC

16. List three types of patient data stored in computers.

    (1)

    (2)

    (3)

17. Describe other computer functions in a pharmacy.

18. Explain what is meant by third-party information and who the three parties are.

19. What is a *patient profile*?

Objective: To discuss the basic functions of the organization of a pharmacy and how data processing is utilized

Directions: Student and instructor should agree on the number of activities assigned for completion by the student. (SCANS C13)

1. Write a brief report on the orientation and training you received at your training station. Did it cover everything you needed to know? What would you add or omit if you were giving the orientation and training? (SCANS C04)

2. Management includes the five functions of planning, organizing, directing, communicating, and controlling. Write a paper to discuss how these are evidenced at the pharmacy where you are assigned. Give two or more examples of each area. (SCANS C12)

3. What brand of computer is found in your assigned pharmacy? What are the advantages and disadvantages of this system? Talk with co-workers to determine how they feel about the computer. Prepare a report with this information. (SCANS C07)

4. List and describe the functions performed by your pharmacy's computer system. Prepare a checklist of these functions and indicate which of these you can do. Indicate those functions performed only by pharmacists. (SCANS C08)

5. Demonstrate how to use the computer in the pharmacy where you are assigned to another student or to a co-worker. Prepare a summary to indicate what you taught. Date the summary, and have your student sign it. (SCANS C10)

6. Locate and list six entities involved in third-party billing from the pharmacy's data control system. Outline the procedure used in billing these six. (SCANS C15)

Objective: To recognize and use terminology relating to the types and effects of drugs (SCANS F01, F02)

A. *Directions:* Using the Student's Manual or a dictionary, define the following terms.

1. absorption
2. allergy
3. chelating agent
4. diagnostic
5. dosage form
6. enzyme
7. metabolite
8. side effect
9. toxicity
10. vaporizer

B. *Directions:* Using "Terms and Definitions," define the following terms.

1. agonist
2. antagonist
3. contraindication
4. indication
5. receptor
6. symptom
7. syndrome

Objective: To recognize terminology relating to prescription drugs (SCANS F10)

Directions: Unscramble the following words.

1. NTIOBAROSP ____________________
2. ALOMTEBMSI ____________________
3. GEODAS MORF ____________________
4. PASLECU ____________________
5. NISLOTOU ____________________
6. TYMOMPS ____________________
7. SHAMCENIM ____________________
8. NITAGOS ____________________

Objective: To differentiate the chemical, generic, and trade names of drugs and their actions and effects (SCANS C05)

Directions: Write answers to the following questions.

1. List the names by which a drug may be identified.

2. Who determines the trade or brand name of a drug?

3. How many of these names may a drug have?

4. What is meant by the term *natural product* when talking about drugs? Give an example.

5. How does a semisynthetic drug differ from a natural drug?

6. Cite three methods of administering drugs in solid form.

   (1)

   (2)

   (3)

7. Why are tablets coated?

8. What is an enteric coating?

9. What is the purpose of a timed-release dosage form?

10. Cite three methods of administering drugs in liquid form.

    (1)

    (2)

    (3)

11. Name six liquid dosage forms.

(1)

(2)

(3)

(4)

(5)

(6)

12. What are six factors that determine the size and strength of dosage of a drug in a particular patient?

(1)

(2)

(3)

(4)

(5)

(6)

13. Why should an infant not be merely considered a little adult and dosed only according to body weight?

14. When would you tell a patient to take the medication if it were to be taken on an empty stomach?

15. Name the two organs involved in ridding the body of foreign substances.

(1)

(2)

16. Differentiate between the actions and the effects of drugs.

17. Distinguish between primary and secondary drug effects.

18. Give another name for secondary drug effects.

19. Distinguish between local and systemic effects of drugs.

20. List two examples of diagnostics.

    (1)

    (2)

21. How many drugs are absolutely safe to take?

22. How is the risk-to-benefit ratio of a drug determined?

Objective: To use a *Physician's Desk Reference (PDR)* to locate information on drugs

Directions: Use a *Physician's Desk Reference (PDR)* or another suitable reference book to research and prepare the following reports. Length, depth, and number of studies is determined by student and teacher in consultation. (SCANS C13)

1. Look up the drug Lasix (Hoechst) mentioned in the Student's Manual. Give the drug's dosage forms, its description, indications, contraindications, and warnings or precautions. (SCANS C07)

2. Report the dosage form, description, indications, actions, and contraindications for the following. You may report by developing a chart, a narrative, or a standardized form. (SCANS C06)
   a. aspirin
   b. a bulk laxative
   c. antiparasitic for use with a scabies infestation

3. Locate and list two chelating agents. Give the dosage form. Tell how each is used. (SCANS C05)

4. Locate and list two antimetabolites. Describe the dosage form and usage of each. (SCANS C05)

5. Locate five timed-release medications in the pharmacy where you are assigned. List the trade names. Determine what diseases or conditions each is used to treat. Note contraindications for each given on the package. Prepare a table or chart to present this information. Discuss this information with another student, or make an oral presentation to your class. (SCANS C10)

Objective: To identify and define routes of drug administration with their advantages and disadvantages (SCANS F08)

Directions: Write answers to these questions.

1. Define *drug administration.*

2. List five items to be considered before the route of administration of a drug is determined.

   (1)

   (2)

   (3)

   (4)

   (5)

3. What is the preferred route of administration if no alternative routes have distinct advantages?

4. What are four advantages, besides rapidity, of intravenous administration?

   (1)

   (2)

   (3)

   (4)

5. Differentiate between delivery sites of intravenous and intra-arterial drugs.

6. Where are intraosseous drugs placed in the body?

7. In what areas/departments of hospitals are intraosseous drugs used?

8. Why must a drug sometimes be injected directly into the cerebrospinal fluid?

9. State another name for intrathecal administration.

10. Why are medications administered through inhalation?

11. What are mucous membranes?

12. What are these structures and where are they located?

    a. peritoneum

    b. pleura

    c. CNS

13. By what routes are medications delivered to mucous membranes?

Learning Activity 2
Word Puzzle

UNIT 10
Routes of Administration

Objective: To identify the routes of drug administration (SCANS F10)

Directions: Fit the words into their proper places in the puzzle squares. To start you off, *oral* has already been inserted. To proceed, find a 14-letter word that begins with *a*. Continue this way until the puzzle is solved.

4-letter words
- oral
- vein

6-letter words
- buccal
- rectal

7-letter words
- topical

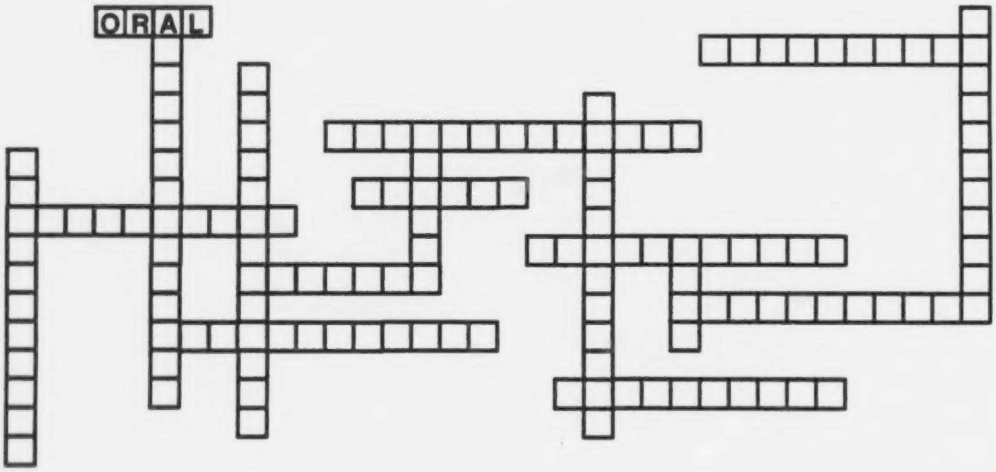
10-letter words
- inhalation
- parenteral
- sublingual

11-letter words
- intradermal
- intrathecal
- intravenous
- suppository

12-letter words
- intrapleural
- subcutaneous

13-letter words
- intraarterial
- intramuscular

14-letter words
- administration



Objective: To define the routes of drug administration with their advantages, disadvantages, and an example of each (SCANS C06)

Directions: Prepare a chart or table to include the following sections: a definition of the word, advantages of the route, disadvantages of the route, and an example of medication administration by each route.

1. buccal
2. intra-arterial
3. intradermal
4. intramuscular
5. intrathecal
6. rectal
7. subcutaneous
8. sublingual
9. topical
10. transdermal
11. parenteral

Objective: To select terms for parts of the circulatory system and abnormal conditions relating to that system (SCANS F08)

Directions: Using "Terms and Definitions" at the beginning of the unit, answer these questions.

1. Select and list the terms that refer to the anatomical structure of the circulatory system. Define each term.

   a.

   b.

   c.

   d.

   e.

   f.

2. Select and list six abnormal conditions associated with the heart and circulatory system. Define these terms.

   (1)

   (2)

   (3)

   (4)

   (5)

   (6)

3. These words are adjectives. To what do they refer in anatomy and physiology?

   a. cardiovascular

   b. extracellular

   c. intracellular

   d. renal

4. Select and list two chemicals produced by the body. Describe the function of each.

(1)

(2)

5. Select and list two terms relating to the heart cycle. With which phase is each concerned?

(1)

(2)

6. Drugs that increase urine output are called (a) ____.

These can be used to remove excess fluid from the body. Accumulation of excess body fluid is (b) ____________________.

7. The clotting of blood is (a) ____.

If the clot forms within a blood vessel, it is termed a (b) ______________________________.

8. What is the adrenergic nervous system?

Objective: To describe the effects of drugs on parts of the cardiovascular system (SCANS F01, F02)

Directions: Write answers to the following questions.

1. What are three functions of the cardiovascular system?

   (1)

   (2)

   (3)

2. Name the parts of the cardiovascular system.

3. Name three ways in which cardiac drugs can affect the heart. Name a drug with each effect.

   (1)

   (2)

   (3)

4. List two cardiovascular conditions for which diuretics are useful.

   (1)

   (2)

5. In recording a blood pressure reading, what do the two numbers mean?

6. Name two types of hypertension.

   (1)

   (2)

7. Is hypertension curable? What is the role of the antihypertensive drugs?

8. What complications occur with untreated hypertension?

9. What are three preferred diuretics in hypertension treatment regimens?

   (1)

   (2)

   (3)

10. Can you name an antihypertensive drug that does not cause vasodilatation?

11. Name four drugs used to elevate blood pressure.

   (1)

   (2)

   (3)

   (4)

12. Name three anticoagulants.

   (1)

   (2)

   (3)

13. What is a disadvantage of heparin as an anticoagulant?

14. What is the clotting vitamin?

Objective: To describe the role cardiovascular drugs play in the treatment of specific conditions

Directions: Select either of the first two projects. Determine how many more to complete in conference with your instructor. (SCANS C13)

1. Make a scrapbook of package inserts from your pharmacy for the following classes of drugs: (SCANS C05)
   a. cardiac drugs
   b. renal drugs (diuretics)
   c. antihypertensives
   d. drugs for hypotension and shock
   e. drugs for other vascular disorders
   f. coagulants and anticoagulants

2. Design a chart to show the same classes of drugs listed in the first question. List by name and manufacturer three examples of drugs in each class that are found in your pharmacy. (SCANS C06)

3. Prepare an oral presentation for your class or to teach a friend. Describe the classes of drugs listed in the first question and their physiological action on the body. Give an example of a drug in each class. (SCANS C10)

4. Select one drug from each of the classes of drugs listed in the first question. Determine what the cost would be to a patient for the average time of treatment, or for one month if the treatment time is extensive. (SCANS C02)

Learning Activity 1
Associating Terms and Definitions

UNIT 12
Gastrointestinal Drugs

Objective: To recognize terminology relating to drugs affecting the gastrointestinal system (SCANS F08)

Directions: Circle the answer that best completes each statement.

1. Hypochlorhydria means
   a. no HCl b. low HCl c. excess HCl d. gastric drug

2. The drug to induce vomiting is called a/an
   a. digestant b. antiemetic c. antacid d. emetic

3. The chemical mediator in the cholinergic nervous system is
   a. adrenaline b. histamine-2 c. acetylcholine d. pepsin

4. The agent to reduce vomiting is a
   a. antiemetic b. emetic c. antacid d. digestant

5. Emesis is another name for
   a. bile b. antidiarrheal c. vomiting d. HCl

6. Drugs that aid in the digestive process are
   a. enzymes b. emetics c. mediators d. digestants

7. The blocker of acetylcholine-mediated nerve impulse propagation is a/an
   a. anticholinergic b. antiemetic c. anthelmintic d. antacid

8. A chemical that occurs naturally in the stomach is
   a. pancreatin b. vitamins c. HCl d. bile

9. Drugs to rid the body of parasitic worms are
   a. antiemetics b. anthelmintics c. digestants d. antidiarrheals

Objective: To describe the roles that gastrointestinal drugs play in the treatment of digestive system disorders (SCANS C05)

Directions: Write answers to the following questions.

1. What are the primary functions of the gastrointestinal system?

2. What is HCl, and where is it found in the body?

3. Why should patients be cautioned about chewing Acidulin tablets?

4. What are some of the functions of bile?

5. What class of drugs forms the mainstay of peptic ulcer therapy?

6. How are anticholinergics useful in the treatment of peptic ulcers?

7. Name two anticholinergics useful in the treatment of ulcers.

   (1)

   (2)

8. List some anticholinergic side effects.

9. What are antispasmodics?

10. Why aren't antihistamines that are used for colds and allergies also effective in preventing HCl secretion from the stomach?

11. In what dosage form is ipecac usually dispensed?

12. Name two prescription-only products used to control diarrhea.

(1)

(2)

Objective: To provide examples of the classes of drugs used in the treatment of specific conditions (SCANS C07)

Directions: You are talking with a pharmacist about patients/customers and their treatment with drugs. She tells you about the following people. Write in the blank the class of drugs that you think should be used in treatment.

1. For one year Dr. Van Hyde has been working in a remote area in Egypt as a technical adviser. He has returned with gastrointestinal problems. He has been diagnosed as having parasitic worms. What class of drug does he need?

   ____

2. Lucy, a retired secretary, has been diagnosed with lung cancer. She has had surgery followed by chemotherapy. Her chemotherapy has made her hair fall out and has left her feeling nauseous. Frequently she vomits. What class of drug does Lucy need?

   ____

3. Baby Jenny O'Brien has been fretful and restless but has no temperature elevation. She has had several watery bowel movements each day. Her mother has taken her to a pediatrician. What class of drugs has the pediatrician probably prescribed?

   ____

4. Little Johnny Brown gets carsick when his family travels. The family is planning a summer vacation including plane travel and a boat ride. What type of preventive medication should be carried for Johnny?

   ____

5. Mr. Normal H. Graystone III has been diagnosed with peptic ulcer disease by his gastroenterologist. What classes of drugs might be considered for his treatment?

   ____

Objective: To locate examples of the classes of gastrointestinal drugs

Directions: Select either of the first two projects. Discuss with your instructor how many more to complete. (SCANS C13)

1. Make a scrapbook of package inserts from your pharmacy for the following classes of drugs. (SCANS C05)
   a. digestants
   b. anticholinergics and histamine-receptor blockers
   c. emetics
   d. antiemetics
   e. antidiarrheals
   f. anthelmintics

2. Design a chart to show the same classes of drugs listed in the first question. List three examples found in your pharmacy of drugs in each class by name and manufacturer. (SCANS C06)

3. Prepare an oral presentation for your class or to teach a friend. Describe the classes of drugs listed in the first question and their physiological actions on the body. Give an example of a drug in each class. (SCANS C10)

4. Select one drug from each of the classes of drugs listed in the first question. Determine what the cost would be to a patient for the average time of treatment or for one month if the treatment time is extensive. (SCANS C02)

5. Using the anatomical chart in figure 1 of this unit in the Student's Manual, develop a drawing or another type of tabulation to show parts of the digestive sysem with the drugs discussed in the unit listed with the correct portion of the system. Students may list additional drugs available from their pharmacies. (SCANS C15)

Learning Activity 1
Recognizing Terminology

UNIT 13
Respiratory Drugs

Objective: To identify parts of the respiratory system (SCANS F08)

Directions: Match the term to the definition by writing the letter in the blank space.

_____ 1. voice box

_____ 2. windpipe

_____ 3. anticough drug

_____ 4. nose, throat, and larynx

_____ 5. small air passage branching off bronchi

_____ 6. measures to prevent spread of disease

_____ 7. bronchi, bronchioles, and trachea

_____ 8. opening up of the breathing tube

_____ 9. sacs at the end of bronchioles

_____ 10. air passageways from trachea to lungs

_____ 11. location of respiratory centers in brain

a. alveoli

b. antitussive

c. bronchi

d. bronchial tree

e. bronchiole

f. bronchodilation

g. larynx

h. medulla oblongata

i. nasopharynx

j. prophylaxis

k. trachea

Objective: To describe functions of the respiratory system and how parts are affected by drugs (SCANS C05)

Directions: Write answers to these questions.

1. What is respiration?

2. Why must respiration continue with no interruption?

3. List the parts of the respiratory system, and discuss their functions.

4. What normally prevents food and drink from going down the trachea instead of the esophagus?

5. Where is the respiratory center located in the brain?

6. Name some of the factors that can alter the rate and depth of respiration.

7. Name two nonrespiratory drugs that can affect the rate and depth of respiration.

   (1)

   (2)

8. What is an antitussive?

9. Name two types of bronchodilators, and give an example of each.

   (1)

   (2)

10. What is cromolyn sodium used for?

11. How is cromolyn sodium administered?

Learning Activity 3
Classes of Drugs (Projects for More Advanced Study)

UNIT 13
Respiratory Drugs

Objective: To describe the classes of respiratory drugs and locate examples of each class

Directions: Select either of the first two projects. Discuss with your instructor how many more of these to complete. (SCANS C13)

1. Make a scrapbook of package inserts from your pharmacy for the following classes of drugs: (SCANS C05)
   a. antitussives
   b. adrenergic bronchodilators
   c. xanthine bronchodilators

2. Design a chart to show the same three classes of drugs listed in the first question. List by name and manufacturer three examples of drugs in each class that are found in your pharmacy. (SCANS C06)

3. Prepare an oral presentation for your class or to teach a friend. Describe the classes of drugs listed in the first question and their physiological actions on the body. Give an example of a drug in each class. (SCANS C10)

4. Select one drug from each of the classes of drugs listed in the first question. Determine what the cost would be to a patient for the average time of treatment, or for one month if the treatment time is extensive. (SCANS C02)

Objective: To identify parts of the central nervous system (SCANS C05)

Directions: Answer the questions using "Terms and Definitions" and information at the beginning of the unit.

1. Select, list, and describe the three parts of a nerve cell.

   (1)

   (2)

   (3)

2. Differentiate between afferent and efferent.

3. Select and describe four abnormal conditions.

   (1)

   (2)

   (3)

   (4)

4. Three classes of nervous system drugs are defined. Select, list, and describe these.

   (1)

   (2)

   (3)

5. State another name for an internuncial neuron and give its function in the body.

6. What is the name for the membranes covering the brain?

7. What term is used for the point of contact between an axon and the dendrite of the next neuron?

8. Describe homeostasis and the two fundamental properties of the nervous system that enable a person's body to maintain it.

Objective: To discuss the functions of parts of the central nervous system and how drugs act as stimulants on these parts (SCANS C06)

Directions: Write answers to the following questions.

1. Distinguish between the CNS and the PNS.

2. Describe the functions of the brain.

3. Explain how the spinal cord is used by the body.

4. What are the three parts of a neuron?

   (1)

   (2)

   (3)

5. List and describe three types of neurons.

   (1)

   (2)

   (3)

6. What are the two major effects that drugs have on the nervous system?

   (1)

   (2)

7. Name two drugs that may be useful in the treatment of hyperactive children.

   (1)

   (2)

8. What are the therapeutic uses of amphetamines?

9. What is the drug-food interaction that is sometimes seen with the monoamine oxidase inhibitors?

10. These drug agents occur naturally. Tell where.

    a. cerebral stimulant

    b. narcotic analgesic

Objective: To determine the effect of depressants on the central nervous system (SCANS C06)

Directions: Write answers to the following questions.

1. Therapeutically, what is the difference between L-dopa and methyldopa?

2. What is the difference between a sedative and a hypnotic?

3. Why should antianxiety agents be used only for short periods of time?

4. What is the serious side effect that can be produced by chlorpromazine and other antipsychotics?

5. What is the therapeutic usefulness of nonnarcotic, prescription analgesics?

6. Name three nonsteroidal anti-inflammatory agents.

   (1)

   (2)

   (3)

7. List and describe the two major types of anesthetics.

   (1)

   (2)

8. What are the two main routes of administration for general anesthetics?

   (1)

   (2)

9. Why are neuromuscular blocking agents used along with anesthetics in surgery?

10. If a drug name has the suffix *caine*, it is probably a ______________________________.

11. Name the drug component used to treat manic depression.

Directions: Fill in the blanks with the correct word.

12. The drug of choice in Parkinson's disease is ____.

13. Two nonbarbiturate sedative-hypnotics are ____ and ____.

14. Flurazepan (Dalmane) is a drug that induces ____________________________ and is chemically similar to _________________ and _____________________________________.

15. Antianxiety agents are also called _________________________________.

16. Painkilling drugs are also called ____.

Objective: To recognize examples of classes of nervous system drugs (SCANS C05)

Directions: Match the drugs to their classifications.

DRUGS

____ 1. Dilantin
____ 2. imipramine
____ 3. Seconal
____ 4. Thorazine
____ 5. Novocaine
____ 6. meperidine
____ 7. chlordiazepoxide
____ 8. halothane
____ 9. Mellaril
____ 10. methaqualone
____ 11. codeine
____ 12. methylphenidate
____ 13. Valium
____ 14. Elavil
____ 15. phenytoin
____ 16. Indocin
____ 17. caffeine
____ 18. Pentothal
____ 19. Motrin
____ 20. Larodopa
____ 21. Darvon
____ 22. Talwin

CLASSIFICATIONS

a. cerebral stimulant
b. narcotic analgesic
c. antidepressant
d. local anesthetic
e. sedative-hypnotic
f. antipsychotic
g. antianxiety agent
h. antiparkinson agent
i. general anesthetic
j. analgesic only
k. anticonvulsant
l. analgesic and anti-inflammatory

Objective: To recognize classes of nervous system drugs and specific examples of each class

Directions: In conference, the student and instructor should agree on the number of these projects for completion. (SCANS C13)

1. Research and prepare a report on one of these conditions. Include cause, types, and treatment. This report may be written or oral. (SCANS C07)
   a. epilepsy
   b. narcolepsy
   c. Parkinson's disease

2. Design a chart to show the three central nervous system stimulant groups discussed in this unit. List three examples from your pharmacy of drugs in each class by name and manufacturer. (SCANS C06)

3. Design a chart to show the six central nervous system depressants discussed in unit 14. List by name and manufacturer three examples of drugs in each class that are found in your pharmacy. (SCANS C06)

4. Use the *Physician's Desk Reference* (*PDR*) and package inserts to research and report on the indications, contraindications, and precautions used in lithium treatment of manic depression. Determine which lithium products are stocked in your pharmacy. (SCANS C07)

5. Develop a report concerning the history, uses, and social implications of opium. (SCANS C03)

6. Select two tranquilizers stocked by your pharmacy. Do a cost comparison to determine the cost of maintaining a patient on each for one month. (SCANS C02)

7. Compile a list of twenty tranquilizers stocked by your pharmacy. Give the name, the manufacturer, and the form (capsule, syrup, injectable, etc.) in which each is available. Use the computer inventory to determine this information, if possible. (SCANS C08)

8. Compile a list of anesthetics stocked by your pharmacy. Classify each as to whether it is a general or local anesthetic. (SCANS C05)

Objective: To correctly use terminology related to the endocrine glands (SCANS C07)

Directions: Use "Terms and Definitions" to answer the following questions.

1. Contrast the prefixes *hyper* and *hypo.*

2. Where are the islets of Langerhans located, and what is their function?

3. What is a hormone?

4. Locate, list, and define three types of hormones secreted by the adrenal cortex.

   (1)

   (2)

   (3)

5. Give another name for the sex glands.

6. In what form is glucose stored in the body of animals?

7. What is the term for constructive metabolism?

Objective: To discuss the sources and functions of hormones and name representative examples found in a pharmacy (SCANS C06)

Directions: Write answers to the following questions.

1. Differentiate between exocrine and endocrine glands.

2. List the three general physiological functions of hormones.

   (1)

   (2)

   (3)

3. List medical uses of hormones and hormonelike drugs.

4. List the six hormones that come from the anterior lobe of the pituitary gland.

   (1)

   (2)

   (3)

   (4)

   (5)

   (6)

5. What are the three gonad-stimulating hormones, and where do they come from?

   (1)

   (2)

   (3)

6. List the two hormones that come from the posterior lobe of the pituitary gland.

(1)

(2)

7. Name three thyroid preparations used in the treatment of hypothyroidism.

(1)

(2)

(3)

8. What are the three major classes of hormones that come from the adrenal glands?

(1)

(2)

(3)

9. What is the major hormone that comes from the pancreas?

10. What disease is caused by a deficiency of insulin?

11. Name and describe two types of diabetes mellitus.

(1)

(2)

12. What is the purpose of hypoglycemics? Give examples of oral hypoglycemics.

13. Name three basic functions of estrogens.

(1)

(2)

(3)

14. List representative estrogens.

15. Name three basic functions of progestogens.

(1)

(2)

(3)

16. List representative progestogens.

17. Name four basic functions of androgens.

(1)

(2)

(3)

(4)

18. List representative androgens.

Learning Activity 3
Glandular Secretions and Functions

UNIT 15
Hormones

Objective: To associate a gland with its hormone and physiological functions (SCANS C07)

Directions: Complete the following table.

Gland	Hormone	Basic Function
testes	______________	development of secondary sex characteristics in males
ovary	______________	development of secondary sex characteristics in females
__________	insulin	______________
__________	______________	controls synthesis and release of hormones from adrenal cortex
__________	cortisone	______________
thyroid	______________	______________
thyroid	______________	______________
__________	______________	controls blood calcium levels
posterior pituitary	______________	responsible for salt and water metabolism

Learning Activity 4
Classes of Drugs (Projects for More Advanced Study)

Objective: To determine the location of endocrine glands, recognize classes of hormonal drugs, describe abnormal conditions, and give examples of hormones commercially available

Directions: In conference, the student and instructor will make selections from the following projects for the student to complete. (SCANS C13)

1. Locate examples of these hormones in your pharmacy. List two examples of each and their manufacturers. (SCANS C05)
   a. pituitary hormones and derivatives
   b. parathyroid hormone(s)
   c. thyroid preparations
   d. insulins
   e. oral hypoglycemics
   f. adrenal hormones
      cortical
      medullary
   g. female sex hormones
   h. male sex hormones
   i. anabolic steroids

2. Select three of the hormones or hormonelike medications found in your pharmacy. Make a comparison study to determine the cost of one month's course of treatment to a patient/customer. (SCANS C02)

3. Prepare a study of two of the following conditions. Describe the signs and symptoms together with the etiology, prognosis, and treatment. (SCANS C05)
   a. goiter
   b. Addison's disease
   c. Cushing's syndrome
   d. myxedema
   e. cretinism
   f. acromegaly

4. Research and prepare a paper to compare causes and manifestations of diabetes mellitus and diabetes insipidus. Describe the complications associated with these diseases. Describe treatment. (SCANS C07)

5. Prepare a report or design a chart to describe the locations of the thymus gland and pineal gland. Name the hormones each produces and give their functions. (SCANS C07)

6. Make a drawing to show all of the endocrine glands and the hormones each secretes. Use it as a basis for teaching another student or your class about the endocrine system. (SCANS C 10)

7. Use a *Physicians' Desk Reference* (*PDR*) to locate all the routes of administration by which insulin can be delivered to a patient. List from 3 to 5 examples of each route. (SCANS C06)

Objective: To correctly use terminology relating to infectious diseases and cancer (SCANS F01, F02, F08)

Directions: Define the terms using the definitions at the beginning of the unit.

1. antibiotic
2. antineoplastic
3. bacteria
4. crystalluria
5. fungus
6. infectious disease
7. malignant
8. metastasize
9. neoplasm
10. pharmacokinetics
11. prophylaxis
12. tubercle
13. virus

Objective: To identify the major classes of anti-infectives and factors governing their use in treatment (SCANS C06)

Directions: Write the answers to the following questions.

1. List the different kinds of microorganisms that can cause disease.

2. Differentiate between bacteriostatic and bactericidal drugs.

3. List four measures by which the problem of drug resistance can be minimized.

   (1)

   (2)

   (3)

   (4)

4. What are the trade names of the combination products containing trimethoprim and sulfamethoxazole?

5. With which group of antibiotics might crystalluria be an effect?

6. How do antibiotics exert their antibacterial effect?

7. Discuss the differences between narrow-spectrum and broad-spectrum antibiotics.

8. What was the first antibiotic discovered?

9. What is penicillinase?

10. Why can't all penicillin derivatives be taken by mouth?

11. Give an example of an antibiotic-food interaction.

12. Give an example of a drug-drug interaction involving antibiotics.

13. What general class of antibiotics is toxic to the kidney and the ear of the host?

14. Erythromycin has antimicrobial activity similar to which other antibiotic?

15. Chloramphenicol resembles which class of antibiotics in its antimicrobial activity?

16. Why is the use of chloramphenicol limited?

Objective: To identify the major classes of anti-infectives and factors governing their use in treatment (SCANS C06)

Directions: Write the answers to the following questions.

1. What are the reasons for multiple-drug therapy in the treatment of tuberculosis?

2. Discuss factors complicating the treatment of human fungal infections.

3. Describe factors the physician must consider in the development of a malarial treatment plan.

4. Distinguish between a benign and a malignant tumor.

5. List the purposes of antineoplastic agents.

6. Why is chemotherapy of cancer frequently so uncomfortable for the patient?

7. List six main types of antineoplastic agents.

   (1)

   (2)

   (3)

   (4)

   (5)

   (6)

8. What is the difference between the antibiotics used for infectious disease and those used in the treatment of cancer?

Directions: Match the drug with its classification.

Drug

____ 9. vinblastine

____ 10. adriamycin

____ 11. 6-MP

____ 12. actinomycin-D

____ 13. Oncovin

____ 14. busulfan

____ 15. methotrexate

Classification

a. antineoplastic-alkylating agent

b. antineoplastic-antimetabolite

c. antineoplastic-antibiotic

d. antineoplastic-alkaloid

Learning Activity 4
Infectious Disease Drugs

UNIT 16
Drugs for Infectious Diseases and Cancer

Objective: To identify examples of drugs within the major classes of anti-infectives (SCANS C06)

Directions: Match the drug to its class.

Drug

_____ 1. cephalexin
_____ 2. ampicillin
_____ 3. cefazollin
_____ 4. oxytetracycline
_____ 5. penicillin G potassium
_____ 6. chlortetracycline
_____ 7. sulfamethoxazole
_____ 8. oxacillin
_____ 9. streptomycin
_____ 10. cefoxitin
_____ 11. methacycline
_____ 12. cephalothin
_____ 13. sulfadiazine
_____ 14. amoxacillin
_____ 15. minocycline

Class

a. penicillin
b. tetracycline
c. sulfonamide
d. aminoglycoside
e. cephalosporin

Objective: To recognize classes of anti-infectives and how they work against pathogens

Directions: In conference, the student and teacher should agree on the number of these projects for completion. (SCANS C13)

1. Devise a chart that will show the names and manufacturers of three specific examples for the following classes of drugs stocked by your pharmacy. (SCANS C06)
   a. sulfonamides
   b. antibiotics
      penicillins
      tetracyclines
      cephalosporins
      aminoglycosides
   c. miscellaneous anti-infective agents
      antitubercular agents
      antifungal agents
      antimalarial agents

2. Research and prepare a report on malaria and its different forms. Give the etiology, prognosis, and treatment. Illustrations may be used to show types and life cycles. (SCANS C07)

3. Describe the discovery, development, and uses of penicillin in a report. (SCANS C03)

4. Research and prepare a report on tuberculosis. Give the etiology, prognosis, and treatment. (SCANS C07)

5. Describe various fungal diseases, their manifestations, and treatment. Illustrations may be included. This report may be written or for oral presentation to the class. (SCANS C10)

6. List and describe methods for destroying pathogens. Discuss the effect of various aseptic methods on bacteria. (SCANS C02)

Objective: To describe the role of self-medication with OTC drugs in the health care system and how federal regulations affect these drugs (SCANS C05)

Directions: Fill in the blanks with the correct word or words.

1. _____________ are the basis for the development of modern pharmacology.
2. An estimated _______________________ Americans use nonprescription medications daily.
3. The American public spends _____________ a year on self-prescribed and self-administered drugs.
4. The estimated _____________ OTC drug products now available actually contain only about ____________________ significant active ingredients.

Directions: Match the numbered items with the lettered definitions or descriptions that follow.

_____ 5. Category I
_____ 6. Category II
_____ 7. Category III
_____ 8. (1972) FDA OTC Drug Products Evaluation Program
_____ 9. (1906) Pure Food and Drug Act
_____ 10. (1966) NAS-NRC-FDA Drug Efficacy Study
_____ 11. (1912) Sherley Amendment
_____ 12. (1962) Kefauver-Harris Amendments
_____ 13. (1938) Food, Drug, and Cosmetic Act
_____ 14. (1951) Durham-Humphrey Amendments

a. Drugs must meet standards of strength and purity claimed by the manufacturer and products containing opiates must say so on the label.
b. Manufacturers may not make false therapeutic claims about a product; difficult to enforce because burden of proof was placed on the government.
c. FDA charged 17 panels of experts to begin a review of active ingredients of all OTC drug products to evaluate their safety and efficacy.
d. Additional data is needed to decide the safety and effectiveness.
e. The drug is not recognized as safe and effective.
f. New drug products must be approved as safe before marketing.
g. Manufacturer must establish safety and effectiveness of all drug marketed after 1938.
h. The drug is generally recognized as safe and effective for the claimed therapeutic indication.
i. Divided drugs into the two classes of prescription and nonprescription drugs.

j. Under contract from FDA, the National Academy of Sciences–National Research Council undertook evaluation of more than 3,400 new drugs that entered the market the between 1938 and 1962, including 512 OTC drugs.

Directions: Answer the following questions.

15. How is self-medication with OTC drugs an essential element in the health care delivery system?

16. If self-medication is to have its proper place in the health care system, what four things must the patient and the pharmacy worker consider?

    (1)

    (2)

    (3)

    (4)

17. What are the six goals of the FDA OTC Products Evaluation Program?

    (1)

    (2)

    (3)

    (4)

    (5)

    (6)

18. What information is required on an over-the-counter product label?

19. How should consumers *not* judge an OTC product?

Objective: To provide information to others concerning OTC products

Directions: In conference with the instructor, select the following projects you are to complete. (SCANS C13)

1. Select three OTC products from your pharmacy. Check the label to determine whether the eight required items are included. Prepare a chart to show how each has complied. Include the product name and the information on the label. (SCANS C07)

2. Explain to a customer/patient, another student, or a new employee the differences between prescription and over-the-counter drugs. Cite specific examples of products. This may be role-played in class with careful preparation or documented from a work situation. (SCANS C10 or C11)

3. Talk with the pharmacist at your pharmacy. Determine which OTC products workers may discuss with customers and which should be referred to the pharmacist. Talk with other workers about their experiences offering advice about OTC products. Prepare a list of 20 or more OTC products about which you feel competent to offer advice. Make a brief notation about each product on your list to identify it. Check with the pharmacist to be certain that your list is appropriate before submitting it to your instructor. (SCANS C09)

4. Select three common OTC products (e.g., aspirin). For each product, conduct a cost comparison of three different manufacturers. Determine which one of the three products in each of the three categories would be the most economical to recommend. Offer data to support your recommendation. (SCANS C02)

Objective: To identify the meanings of terms related to conditions in the gastrointestinal tract (SCANS F01, F02, F08)

Directions: Answer these questions using "Terms and Definitions" at the beginning of the unit.

1. Select and define two terms indicating disease in the GI tract.

   (1)

   (2)

2. Select and define a term indicating an abnormal condition of the body.

3. What name is given to bacteria normally found in the gastrointestinal tract?

4. Select and define four terms for types of medications.

   (1)

   (2)

   (3)

   (4)

5. Differentiate between feces and flatus, both of which are found in the digestive tract.

6. Differentiate between defecation and diarrhea.

7. What is the name for a poisonous substance?

8. Select (a) a term used to describe the neutralization of acid in the stomach, and (b) a term used to describe how the stomach responds to the neutralization of acid.

   (a)

   (b)

9. Differentiate between peristalsis and regurgitation as to the direction in which they occur.

10. Select terms that describe medications that (a) taste good and (b) affect the whole body.

(a)

(b)

Objective: To identify the main objectives of treatment with antacids (SCANS C06)

Directions: Answer the following questions.

1. What do people use antacids to treat?

2. How is drug-induced indigestion usually alleviated?

3. For what conditions may physicians recommend antacids?

4. What is the objective of treatment with antacids?

5. Which is the most effective dosage form of antacids?

6. When is the best time to take antacids?

7. What is the most significant drug-drug interaction involving antacids?

8. List the six ingredients commonly found in over-the-counter antacids.

   (1)

   (2)

   (3)

   (4)

   (5)

   (6)

9. Why is it important for the patient to be aware of the sodium content of antacids?

10. What is the function of simethicone in antacids?

11. What factors should be considered in the selection of OTC antacids?

Objective: To describe the ingredients and uses of antidiarrheal and laxative products (SCANS C06)

Directions: Write the answers to the following questions.

1. Identify the two general types of diarrhea and their causes.

   (1)

   (2)

2. How do the common antibiotics cause diarrhea?

3. What bacteria are the most common cause of infectious diarrhea in adults?

4. Which type of infectious diarrhea is most often found in children?

5. Other than viral infections, what may cause acute diarrhea in infants?

6. How does exposure to different food and drink cause traveler's diarrhea?

7. What four agents comprise most nonprescription antidiarrheals?

   (1)

   (2)

   (3)

   (4)

8. What are the most common adsorbents used in antidiarrheal preparations?

9. What is gastrointestinal motility?

10. List three common uses of laxative products.

    (1)

    (2)

    (3)

11. What are the common causes of constipation?

12. What would the ideal laxative be like?

13. List the five general classes of laxatives, and give two examples of each.

    (1)

    (2)

    (3)

    (4)

    (5)

14. Describe the action of the saline laxatives.

15. Explain how the stimulant laxatives operate in the body.

16. Describe the action of a bulk-forming laxative in the intestine.

17. Explain the meaning of the term *surfactant,* and tell which laxatives are considered surfactants.

Objective: To organize and disseminate information concerning nonprescription medication for the gastrointestinal system

Directions: Discuss these projects with your instructor. Agree on those suitable for study. (SCANS C13)

1. Now that you are working in a pharmacy, people ask you for advice concerning medication for use with diarrhea. Devise a series of questions, which could be placed on one sheet of paper, to use in evaluating each situation. (SCANS C11)

2. From product information in your pharmacy, develop a chart showing the differences in the ingredients in the following antacids. (SCANS C07)
   a. Camalox and Maalox
   b. Gelusil, Gelusil II, and Gelusil M
   c. Maalox, Maalox #2, and Maalox Plus
   d. Mylanta and Mylanta II
   e. Riopan and Riopan Plus
   f. Pepto-Bismol tablets and Pepto-Bismol liquid

3. From product information in your pharmacy, devise a chart showing the differences in the ingredients in the following antacids: Parepectolin, Infantol Pink, Donnagel, Lactinex, and Bacid. (SCANS C07)

4. From product information in your pharmacy, devise a chart to show differences in the ingredients in the following bulk-forming laxataives: Metamucil, LA Formula, Effersyllium, Konsyl, and Maltsupex. (SCANS C07)

5. Prepare an advertising campaign for a new laxative that you have just invented. You believe it to be the ideal laxative. (SCANS F07, F10)

6. Make a chart to show the purpose, side effects, and contraindications for antacids, antidiarrheal agents, saline laxatives, stool softeners, and stimulant laxatives. (SCANS C06)

Learning Activity 1
Pain, Aspirin, and Other Analgesics

UNIT 19
Analgesics

Objective: To discuss the function of pain in the body and how various dosage forms of analgesics are used to treat it (SCANS C05)

Directions: Answer the following questions.

1. What are analgesics?

2. What is the function of pain in the body?

3. What factors influence pain?

4. What are the two categories into which pain may be divided?

   (1)

   (2)

5. What is a placebo and how is it used?

6. Name the most common type of pain.

7. List the several forms of headache, and describe how each affects the body.

8. Which nonprescription analgesic is used most often? State its chemical name.

9. What do recent studies indicate to be the mode of action of aspirin?

10. List the three primary effects of aspirin.

    (1)

    (2)

    (3)

11. On what structure does aspirin act to relieve pain?

12. List the four side effects of aspirin.

    (1)

    (2)

    (3)

    (4)

13. What is one of the leading single causes of accidental poisoning in children under five?

14. State the two main purposes of emergency treatment for aspirin poisoning.

    (1)

    (2)

15. What is the emergency treatment for aspirin poisoning?

16. List two other ingredients found in nonprescription analgesic products.

    (1)

    (2)

17. What are five analgesic dosage forms?

    (1)

    (2)

    (3)

    (4)

    (5)

18. Distinguish between regular-strength Tylenol and extra-strength Tylenol.

19. What is enteric-coated aspirin?

20. If you were a customer trying to select an analgesic product, what factors would you consider?

21. Define these terms:

    a. antipyretic
    b. hepatotoxin
    c. inflammation

Learning Activity 2
Comparison of Analgesics (Projects for More Advanced Study)

Objective: To compare popularity, effectiveness, and cost of OTC analgesics in a pharmacy

Directions: Discuss these projects with your instructor. Decide which activities you are to complete and how you are to report your findings. (SCANS C13)

1. Design a chart and keep a record of purchases of OTC analgesics in your pharmacy for a week. Compare sales of different brands of the same type (e.g., one baby aspirin with another, one liquid product with another). Report your findings to the instructor in written form. (SCANS C05, C06)
2. Consult the pharmacist about recommendations for analgesic products. Ask the pharmacist why those products should be recommended. Prepare a record of the recommendations for your future use with customers. (SCANS C09)
3. Do a study at your pharmacy to determine the retail price of the different product types of analgesics. Use unit cost as a basis for your study. Determine which type is cheapest, which is most expensive, and reasons for variations in prices. Report these findings to the class orally or in a written report. (SCANS C02)
4. Use the patient records in the computer to locate three customers/patients allergic to aspirin. (SCANS C08)

Learning Activity 1
Developing Vocabulary

UNIT 20
Allergy, Cough, and Cold Products

Objective: To correctly use terminology relating to colds and allergy and the treatment of these conditions (SCANS F08)

Directions: Use "Terms and Definitions" at the beginning of the unit to answer the following questions. Circle the term that completes the sentence or answers the question.

1. The *rhino* part of the terms *rhinorrhea* and *rhinovirus* means
   a. throat b. lungs c. nose d. pharynx

2. The rhinovirus affects which body system?
   a. reproductive b. digestive c. circulatory d. respiratory

3. An agent that reduces swelling in nasal passages is a/an
   a. decongestant b. demulcent c. expectorant d. antihistamine

4. An agent to block the action of histamine at the histamine-receptor site is a/an
   a. decongestant b. demulcent c. expectorant d. antihistamine

5. An agent to soothe the throat is a/an
   a. decongestant b. demulcent c. expectorant d. antihistamine

6. An excessive amount of mucous secretions accumulating in body tissues causes what?
   a. lesions b. fever c. congestion d. allergies

7. Inflammation of the throat is called
   a. rhinorrhea b. pharyngitis c. expectoration d. runny nose

8. A physician would call a runny nose
   a. pharyngitis b. rhinovirus c. rhinorrhea d. congestion

9. A small dry disk of oral medication is called a/an
   a. capsule b. lozenge c. inhalant d. drops

Objective: To determine the causes, symptoms, and treatments for common colds and allergies (SCANS C05 and C06)

Directions: Answer the following questions.

1. At what times do the peak seasons for the common cold occur?

2. What causes the common cold?

3. How many different viral strains have been isolated that cause colds?

4. Which virus accounts for more than half of all the common colds in adults?

5. Name the age group most susceptible to colds.

6. What are symptoms of the common cold?

7. What are some of the side effects of antihistamines?

8. List three antihistamines used in nonprescription products.

   (1)

   (2)

   (3)

9. Explain how nasal decongestants act within the body.

10. What is the best way to administer nasal drops?

11. Point out problems encountered with using too much nasal spray or drops too often.

12. List three topical decongestants used in nonprescription products.

(1)
(2)
(3)

13. Warnings are placed on oral decongestant labels. With what health conditions are oral decongestants contraindicated?

14. List three oral decongestants used in nonprescription products.

(1)
(2)
(3)

15. What does the action of an expectorant do?

16. Name three expectorants found in over-the-counter cough preparations.

(1)
(2)
(3)

17. Describe how the antitussive agents act on the body.

18. For what kind of cough should you not recommend an antitussive?

19. Name three cough suppressants found in over-the counter cough preparations.

(1)
(2)
(3)

20. What are the causes of pharyngitis?

21. What diseases besides a cold may pharyngitis be a symptom of?

22. What should you do if a patient's symptoms persist more than 5 to 7 days?

Objective: To provide information on products used and recommended locally

Directions: Discuss these activities with your instructor. Determine the time allowed for accumulation of date, preparation, and reporting. (SCANS C13)

1. Construct a chart of the 20 most popular cold, cough, and allergy remedies in your pharmacy. Either observe sales for a week or ask your pharmacist which 20 products sell the most. From product information in the pharmacy and information in this unit, indicate on the chart the ingredients of each remedy and the symptoms each one is intended to treat. (SCANS C07)

2. Based on information you have collected, conduct a role-playing situation in class. A customer comes into the pharmacy with certain symptoms. What product would you recommend in each case? (SCANS C10 and C11)
   a. stuffy nose and headache
   b. cough and chest congestion
   c. six-month-old baby with cough and chest congestion
   d. nasal congestion (customer had high blood pressure)
   e. aches, fever, stuffy nose, and nonproductive cough

3. Using a friend or a mannequin, demonstrate how to administer nose drops. (SCANS C10)

Objective: To discuss the role of vitamins and minerals in nutrition (SCANS C05, C06)

Directions: Answer the following questions.

1. What is a vitamin?

2. What is the role of vitamins in nutrition?

3. Name five life circumstances that may increase a person's need for certain vitamins beyond the ordinary amounts.

   (1)

   (2)

   (3)

   (4)

   (5)

4. Which vitamins are formed in the human body?

5. List the two basic categories of essential vitamins and the vitamins found in each category.

   (1)

   (2)

6. What does RDA mean?

7. What is hypervitaminosis? How does this occur?

8. Explain the function of a coenzyme and give an example of one.

9. What are three natural dietary sources of each of the following fat-soluble vitamins?

   a. Vitamin A

   b. Vitamin D

   c. Vitamin E

   d. Vitamin K

10. Select and list the vitamin that is never sold over-the-counter.

11. Which vitamins are obtained from meat?

12. What is a mineral?

13. Name five minerals found in multivitamin formulas.

   (1)

   (2)

   (3)

   (4)

   (5)

14. Refer to table 1 to answer the following questions.

   a. What is the total amount of the five B-complex vitamins required each day?

   b. Which mineral(s) do we need the most each day? How much?

Learning Activity 2
Chemical Names

Objective: To relate a vitamin to its chemical name (SCANS C05)

Directions: Match the following.

_____ 1. retinol
_____ 2. ergocalciferol
_____ 3. tocopherol
_____ 4. menadione
_____ 5. ascorbic acid
_____ 6. thiamine
_____ 7. cyanocobalamine
_____ 8. pyridoxine
_____ 9. niacin
_____ 10. riboflavin

a. pantothenic acid
b. vitamin B_1
c. vitamin B_2
d. vitamin B_3
e. vitamin B_6
f. vitamin B_{12}
g. vitamin K
h. vitamin E
i. vitamin D
j. vitamin A
k. vitamin C

Learning Activity 3
Deficiency Diseases

UNIT 21
Nutritional Supplements, Vitamins, and Minerals

Objective: To relate a deficiency disease to the vitamin that can correct the condition (SCANS C07)

Directions: Select the correct answer and write the letter in the blank.

_____ 1. Vitamin C deficiency disease
a. pellagra
b. beriberi
c. ricketts
d. scurvy

_____ 2. Vitamin K deficiency disease
a. pellagra
b. hypoprothrombinemia
c. macrocytic anemia (large red blood cells)
d. pernicious anemia

_____ 3. Folic acid deficiency disease
a. pellagra
b. hypoprothrombinemia
c. macrocytic anemia (large red blood cells)
d. pernicious anemia

_____ 4. Niacin deficiency disease
a. pellagra
b. hypothrombinemia
c. macrocytic anemia (large red blood cells)
d. ricketts

_____ 5. Vitamin B_1 deficiency disease
a. pellagra
b. hypoprothrombinemia
c. ricketts
d. beriberi

_____ 6. Vitamin B_{12} deficiency disease
a. pellagra
b. hypoprothrombinemia
c. macrocytic anemia
d. pernicious anemia

Learning Activity 4
Functions of Vitamins and Minerals

Objective: To relate a vitamin or mineral to its function in the body (SCANS F08, C07)

Directions: Match the vitamin with its functions.

a. vitamin A
b. vitamin D
c. vitamin E
d. vitamin K
e. Vitamin C
f. thiamin (B_1)
g. riboflavin (B_2)
h. niacin (B_3)
i. pyridoxine (B_6)
j. cyanocobalamine (B_{12})
k. folacin (folic acid)
l. pantothenic acid
m. biotin

____ 1. helps in the formation and maintenance of healthy eyes, skin, hair, teeth, gums, and various glands
____ 2. assists in forming body proteins and genetic material and also in the formation of hemoglobin
____ 3. necessary for the building of genetic material, the formation of red blood cells, and the proper functioning of the nervous system
____ 4. assists the body to properly utilize calcium and phosphates
____ 5. necessary for the absorption and metabolism of proteins and fats and the formation of red blood cells
____ 6. essential for the formation of red blood cells, muscle, and other tissue and prevents oxidation of vitamin A and fats
____ 7. essential in the synthesis of prothrombin
____ 8. necessary for the release of energy to cells from carbohydrates, proteins, and fats
____ 9. necessary for the formation of collagen, which supports body structures
____ 10. works with thiamine and riboflavin in energy-producing reactions in cells

Directions: Match the mineral with its functions.

a. calcium
b. copper
c. iodine
d. iron
e. magnesium
f. phosphorus
g. potassium
h. zinc

____ 11. helps with skeletal growth and the repair of tissue
____ 12. aids in formation and repair of bones and teeth
____ 13. necessary for production of red blood cells
____ 14. strengthens bones, teeth, and soft tissues
____ 15. involved in storage and release of iron to form hemoglobin
____ 16. maintains electrolyte balance and the functioning of the nervous, cardiovascular, and muscular systems
____ 17. essential to functioning of thyroid gland
____ 18. needed with calcium to build and maintain bones and teeth, to release energy, and to contract the muscles

Objective: To become familiar with nutritional supplements, vitamins, and minerals available in your pharmacy

Directions: Set up a conference with your instructor to determine how many of the following activities to complete. (SCANS C13)

1. Using information in your pharmacy, make a chart and compare at least five different multivitamin formulas according to ingredients, dosage, and price. (SCANS C02)

2. Make a chart and compare at least three different B-complex vitamin formulas according to ingredients, dosage, and price. (SCANS C02)

3. Conduct at least a week-long survey on the most often requested vitamins in your pharmacy. (SCANS C04)

4. Conduct research and prepare a report on the signs, symptoms, etiology, and treatment of one of the following deficiency diseases: beriberi, pellagra, ricketts, or scurvy. (SCANS C07)

Learning Activity 1
Poison Ivy Products

UNIT 22
Products for the Skin

Objective: To describe symptoms and treatments for poison ivy and poison oak dermatitis (SCANS C05)

Directions: Answer the following questions.

1. What are the most common sites of contact dermatitis?

2. What is the causative agent for poison ivy and poison oak dermatitis?

3. In what portions of the plant is the toxin located?

4. Describe the symptoms of poison ivy and poison oak dermatitis.

5. What are three indirect ways you can be exposed to poison ivy or poison oak?

   (1)

   (2)

   (3)

6. What are the major objectives of treatment for poison ivy and poison oak dermatitis?

7. What kind of prescription-only drugs are commonly used in the systemic treatment of severe reactions to poison ivy?

8. What are the four major types of OTC medications used in products for the treatment of poison ivy and poison oak dermatitis?

   (1)

   (2)

   (3)

   (4)

9. Name three local anesthetics found in poison ivy products.

   (1)

   (2)

   (3)

10. What are three of the most popular brands of hydrocortisone products now available over-the-counter?

    (1)

    (2)

    (3)

11. Define these terms.

    a. astringent

    b. dermatitis

    c. erythema

    d. pruritus

Learning Activity 2
Burn Products

UNIT 22
Products for the Skin

Objective: To identify the three levels of severity of drugs and how they are treated (SCANS C05)

Directions: Answer the following questions.

1. What is a burn?

2. What are the three categories of burns, and how do they differ?

   (1)

   (2)

   (3)

3. List the four types of burns according to what causes them.

   (1)

   (2)

   (3)

   (4)

4. What are the symptoms of severe sunburn?

5. During what hours of the day will you burn faster?

6. What is photosensitivity?

7. How can you tell the difference between true sunburn and photosensitivity?

8. Name four drugs that can cause photosensitivity.

(1)

(2)

(3)

(4)

9. What are the first two considerations in the treatment of all burns?

(1)

(2)

10. Why is cryotherapy used in the treatment of burns?

11. Define *cryotherapy*.

12. List four steps in the treatment of a minor burn.

(1)

(2)

(3)

(4)

13. Identify three common bacterial organisms that will colonize in a burned area.

(1)

(2)

(3)

14. Name four common local anesthetics used for burns, and give a trade name for each.

(1)

(2)

(3)

(4)

15. What is the concentration of benzocaine in most commercial products?

16. Why should topical anesthetics not be used on more serious burns?

17. What are the three dosage forms for most over-the-counter burn preparations, and what are the advantage or disadvantages of each?

(1)

(2)

(3)

18. What two basic principles should you remember in the treatment of burns?

(1)

(2)

Objective: To apply knowledge of skin products to situations in the pharmacy (SCANS C07)

Directions: Situations that you might encounter with customers/patients are described below. Identify the condition and tell what you would recommend.

1. Ms. Roberts comes to the pharmacy complaining about blisters and a rash on her face which itches. She tells you that she has been clearing the yard around her farmhouse which had become overgrown with weeds. She uprooted a vine that she thought could be poison ivy. However, she wore long sleeves and gloves when working. She remarks that she moved the vine with a rake to burn it and did not touch the vine at all. What do you suspect has happened?
2. Your friend Ronnie spent the weekend at the beach. Now he comes to you for advice. He went to sleep facedown on the sand just before lunch on Saturday. Now, he has a severe sunburn with swelling and blisters down his back and legs. He explains that it is painful, and he feels as though he has fever. He asks whether he should see a doctor or just get some salve at the pharmacy. What do you tell him?
3. A man comes into the pharmacy with what he tells you is poison oak rash down his left arm. He says that it has been there several days and is much better. Now he needs something to relieve the itching. What types of medications could you suggest?
4. A woman requests Burow's solution at the pharmacy. What type of problem do you suspect she has?
5. A young woman has been on Achromycin treatment, which she purchased at your pharmacy. She states that she is an accountant who works mostly indoors. She rarely goes outside except to walk her dog. Now her skin is red as though it were sunburned. What do you suspect?

Learning Activity 4
Projects for More Advanced Study

Objective: To recognize nonprescription drugs for use with poison ivy and poison oak dermatitis or on burns

Directions: During a conference with your instructor, determine how many of the following activities to complete. (SCANS C13)

1. Conduct research to report on three additional skin problems—acne, eczema, and impetigo. Determine what causes these conditions. Describe how they are treated and what is available in your pharmacy for the treatment of each condition. (SCANS C03)
2. Make a comparison study of a product in your pharmacy containing topical forms of benzocaine, dibucaine, and lidocaine as to strengths, costs, and precautions for use. (SCANS C03)
3. Compile a list of antipruritic agents available at your pharmacy. Talk with the pharmacist to determine which products should be recommended for poison ivy or poison oak treatment. Indicate these on your list. Also indicate any of these agents that could be used on burns on the intact skin. (SCANS C09)

Learning Activity 1
Scrambled Terms

UNIT 23
Weight Control Products

Objective: To become familiar with terms relating to weight control products (SCANS F10)

Directions: Unscramble the following letters to form words.

1. ITDE DAI	1. ________________
2. YSHUPHALMOAT	2. ________________
3. PEYPOAOAIEHNLRPNLMN	3. ________________
4. ETOYSIB	4. ________________
5. OTVHRGWIEE	5. ________________
6. EALCROI	6. ________________
7. AOETCNRCI	7. ________________
8. NRXAAOEI	8. ________________

Objective: To discuss the causes and treatment of obesity and overweight (SCANS C05)

Directions: Answer the following questions.

1. List three reasons why the diet aid market has increased so dramatically recently.

   (1)

   (2)

   (3)

2. How much over the average weight must you weigh to be considered obese?

3. Differentiate between exogenous and endogenous obesity.

4. List and briefly describe six theories concerning the causes of obesity.

   (1)

   (2)

   (3)

   (4)

   (5)

   (6)

5. What three health problems may obese people experience?

   (1)

   (2)

   (3)

6. What area of the brain controls your response to sight, smell, and taste of foods?

7. What is the role of the hypothalamus in weight control?

8. How many calories must you eliminate from your diet to lose one pound of body weight?

9. Name two groups who use behavior modification and group therapy to help people lose weight.

   (1)

   (2)

10. Define *anorectic.*

11. Why is the use of amphetamines and related drugs undesirable in weight control?

12. Name the four major ingredients in over-the-counter diet aids.

    (1)

    (2)

    (3)

    (4)

13. What is the dosage recommendation set by the FDA for phenylpropanolamine?

14. What are the adverse side effects associated with phenylpropanolamine?

15. When is the use of phenylpropanolamine contraindicated?

16. What is a common use for phenylpropanolamine other than as an appetite suppressant?

17. What is benzocaine used for in appetite suppressant products?

18. How do the methylcellulose and carboxymethylcellulose products induce weight loss?

19. Why is caffeine used in combination with phenylpropanolamine?

20. List six other methods of weight control besides OTC products.

(1)

(2)

(3)

(4)

(5)

(6)

21. What should be the four components of any weight loss program for the average person?

(1)

(2)

(3)

(4)

Objective: To evaluate weight loss products

Directions: During a conference with your instructor, determine how many of the following activities to complete. (SCANS C13)

1. Make a comparison chart on the most often requested diet aids in your pharmacy. Compare the prices of the products selected. Which product would you recommend to the consumer? Why? (SCANS C 11)

2. Survey the number of times over-the-counter diet products are advertised on television, in magazines, and in the newspaper for a week. Clip advertisements from newspapers, magazines, and list and date the TV commercials for a report. Be sure to indicate sources of the printed ads. (SCANS C05)

3. Explain to a new employee or customer the location and arrangement of the weight control products in the pharmacy. Describe components present in different products. The student may report by role-playing in class or preparing a written report with a map or drawing to locate the products. (SCANS C10)

Learning Activity 1
Supplies and Accessories

UNIT 24
Health Care Accessories

Objective: To name and discuss types of surgical supplies and health care accessories (SCANS C06)

Directions: Write answers to the following questions.

1. Name a good way for pharmacy workers to learn drug and accessory names.

2. What is the reason for placing new or fresh stock behind the old on pharmacy shelves?

3. Name five types of surgical supplies.

   (1)

   (2)

   (3)

   (4)

   (5)

4. What is an absorbent? Give two examples.

5. Differentiate between dressings and bandages.

6. What is an accessory?

7. Name the nine groups of health or prescription accessories that are commonly stocked in pharmacies.

   (1)

   (2)

   (3)

   (4)

   (5)

(6)

(7)

(8)

(9)

8. What are trusses?

9. Define these terms.

   a. ostomy

   b. stoma

10. Describe three type of ostomies and the appliances each requires.

    (1)

    (2)

    (3)

11. List and discuss the differences among the various types of thermometers.

12. List the range in needle gauge size, beginning with the smallest gauge.

13. List three types of walkers, using figure 3 as a reference.

    (1)

    (2)

    (3)

14. List four types of canes, using figure 4 as a reference.

    (1)

    (2)

    (3)

    (4)

15. Why would a quad cane be prescribed for a patient?

16. List two types of crutches and explain the use of each.

(1)

(2)

Objective: To determine supplies and accessories available in local pharmacies

Directions: The student and teacher should meet in conference to decide the format for this project. Results may be presented as an inventory, a chart, or a series of drawings. The time frame for the project should also be determined. (SCANS C13) List the types of supplies and equipment available in the following categories in your pharmacy. (SCANS C03)

a. Dressings
b. Protectives
c. Trusses
d. Incontinence supplies
e. Thermometers
f. Vaporizers
g. Walkers
h. Canes
i. Crutches